

50X1-HUM

Brief Abstract of "For the Materialistic Illumination of
The Fundamentals of Quantum Mechanics"

Voprosy Filosofii, L. I. Storchak
Moscow/Leningrad
No 3, Jun/Jul 1951

50X1-HUM

CONFIDENTIAL

ONE-PAGE ABSTRACT "FOR THE MATERIALISTIC ILLUMINATION OF THE
FUNDAMENTALS OF QUANTUM MECHANICS"

L. I. Storchak

[Note: The following is an abstract of an article, with the above title, which appeared in the 'Criticism and Bibliography' regular section of the journal Voprosy Filosofii (Problems of Philosophy), No 3 (Jun-Jul 1951), pages 202-205. This article represents a favorable review, by L. I. Storchak (a resident of the city of Barnaul), of D. I. Blokhintsev's book entitled Osnovy Kvantovoy Mekhaniki (Fundamentals of Quantum Mechanics), published 1949 in Moscow and Leningrad by the State Press of Technical-Theoretical Literature; revised 2nd edition, 588 pages. The 1st edition appeared in 1944.

According to the Central Committee and the discussions in 1947 by A. A. Zhdanov, scientific theories must be materialistic, which requirement the reviewed book satisfies, critic Storchak shows.⁷

Bourgeois scientists like Bohr, Heisenberg, Schroedinger distorted the quantum theory. This was first pointed out and criticized by K. V. Nikolskiy (cf Uspekhi Fizicheskikh Nauk, Vols 16 and 17 (1936-1937) and his monograph of 1940).

Blokhintsev expounds theories in a materialistic, not idealistic, way, the difference between the first edition of his book and the second one being obviously and due mainly to the ideology of the Central Committee, particularly to discussions initiated in 1947 by A. A. Zhdanov. Blokhintsev was also much helped and guided by the criticism of M. A. Markov's article "On the Nature of Physical Knowledge".

- 1 -

CONFIDENTIAL

CONFIDENTIAL

Flokhintsev's particles are atomic and materialistic. "The mass, charge etc of particles of the same type do not vary; the only transformations we know is that of one type of particle into another type" (page 19). The atomism of particles possesses well defined properties: mass, charge, etc which are identical for the same type of particles and invariable; particles act as entities, but may undergo mutual transformations. At the same time particles display wave properties; namely, scattering. Therefore continuity and discontinuity are part of the nature of elementary particles and are the basis of quantum mechanics. This proves the defect in Schroedinger's "wave packet" and other hypotheses (page 43).

Flokhintsev attempts to find the real meaning of Planck's constant h ; namely, as a boundary between macro- and microphysics. Phenomena connected with the h are called quantum. The existence of a quantum of action leads to the phenomenon of scattering in particles (page 74).

The central problem in the philosophy of nature is the confirmation of materialism, which is well achieved in this book, and the abolishment of bourgeois idealism.

- E N D -

- 2 -

CONFIDENTIAL

C I A

50X1-HUM

50X1-HUM

9 Oct 1951

Cambrian Archeozooids of the Eastern Slopes of Kuznets Ala-Tau

Vestnik Akademii Nauk SSSR
Moscow, Dec 1950

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CAMBRIAN ARCHEOCYATHS OF THE EASTERN SLOPES OF KUZNETS ALA-TAU

[Note: The following anonymous article appeared in the regular 'Defense of Dissertations' section of the journal Vestnik Akademii Nauk SSSR, No 12 (December 1950), page 105.]

Archeocyaths are fossil marine invertebrates with a complicated calcareous porous skeleton. Very rough counts show that the greatest quantity of their types and forms are found in the USSR, where more than 85 deposits of archeocyaths have been located, whereas in all the rest of the world there are only about 30 deposits.

The deposits of archeocyaths on Salagir, Alta, in Kuznets Ala-Tau, in the Eastern and Western Sayans and in Tuva are the most numerous. The remains of these ancient fossil animals, which are far from completely investigated, are of great interest also to geologists, and to all who occupy themselves with the study of the evolution of the organic world in its earliest periods.

In the current year, 1950, it will be a hundred years since the time of the first finding of archeocyaths. They were first encountered by the engineer Meglits, in Siberia in limestone along the Lena river.

In his dissertation on archeocyaths, scientific co-worker I. T. Zhuravlev of the Paleontological Institute, Academy of Sciences USSR, has investigated the structure and systematization of the beginnings of ontogeny and phylogeny of some archeocyathic types collected on the boundaries of the eastern slopes of Kuznets Ala-Tau. The dissertation was defended by I. T. Zhuravlev at a meeting of the scientific council of the Paleontological Institute in the competition for the scientific degree of candidate of biological sciences.

- 1 -

CONFIDENTIAL

CONFIDENTIAL

The dissertation begins with a short account of the history of the study of archeocyaths. The main attention is directed to recent works which have not yet received critical evaluation in Soviet literature. Further, he clarifies the stratigraphical significance of the archeocyaths of Siberia, Tuva and Mongolia, and examines established concepts concerning the growth of horizons with archeocyaths.

The author concludes that the horizons with archeocyaths can not be dated younger than the lowest limits of the middle Cambrian. Until most recently it was considered that they characterize, besides the lower Cambrian, also the whole middle division of this system. These essential changes in the concepts concerning the growth of archeocyathic fauna possess great significance for stratigraphy.

A special chapter is devoted to a detailed richly-illustrated abstract of contemporary data on the structure of archeocyath skeletons. The author distinguishes two new structural types of external walls of archeocyathic skeletons, which supplement the six types established earlier.

According to the report of the official opponent, Doctor of biological sciences N. F. Gekker, an attentive intimate knowledge of Soviet literature about archeocyaths and the study of numerous collections allowed I. T. Zhuravlev to give an extraordinarily complete chapter on the morphology of archeocyaths and to make the first sketch of the phylogeny of this group of animals.

Positive reports about the work of I. T. Zhuravlev were given also by another opponent, doctor of biological sciences D. M. Fedotov, and by candidate of geologico-mineralogical sciences V. P. Maslov.

- E N D -

- 2 -

CONFIDENTIAL

CONFIDENTIAL

1512

C I A

FOREIGN DOCUMENTS DIVISION

Oct 51

50X1-HUM

Nonstationary Motion of Ground Waters
With a Free Surface

Prikladnaya Matematika i Mekhanika, Vol
XI, pages 231-6, N. K. Kalinin (deceased)
and P. Ya. Polubarinova-Kochina, Moscow
and Leningrad, March/April 1947.

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

NONSTATIONARY**UNSTEADY MOTION OF GROUND WATERS****WITH A FREE SURFACE**

N. K. Kalinin and E. Ya. Kolubarinova-Kochina

(Moscow)

1. Usually, when investigating ~~unsteady~~ motion of ground waters, subject to the Darcy law, the forces of inertia are fully overlooked in the equations expressing this motion. In case of a motion parallel to a plane (in our case, parallel to a vertical plane), the problem is reduced to the finding of the velocity potential $\Phi(x, y, t)$ that will satisfy the Laplace [differential] equation $\frac{\partial^2 \Phi}{\partial x^2} + \frac{\partial^2 \Phi}{\partial y^2} = 0$, and, also, some finite and initial conditions. In the same time, the filtration rate components are determined by equations

$$v = \frac{\partial \Phi}{\partial x} = -\mu \frac{\partial \Phi}{\partial x}, \quad w = \frac{\partial \Phi}{\partial y} = -\mu \frac{\partial \Phi}{\partial y} \quad (1.1)$$

where

$$p = -\kappa \left(\frac{p}{\gamma} - y \right) = -\frac{k}{\mu} (\rho - \gamma y) \quad (1.2)$$

where p is the pressure, γ the specific gravity of the liquid in motion, κ the coefficient of filtration, m the porosity value of the ground, k the permeability value of the ground, μ the viscosity of the liquid. Axis y is directed vertically down.

[κ][μ][ω]

By ~~interpolating~~ ^{inserting} the complex potential $\omega = \Phi + i\psi$ and the complex variable

$$w = -\frac{\kappa}{\gamma} (p + i p_1) = p + i p_1$$

which is proportional to the complex pressure (p is a harmonic function conjugate with $\bar{p}$), we will, on the basis of (1.2), obtain:

$$\omega = W - K'z \quad (1.3)$$

On a free surface, where the pressure is constant, the boundary conditions will be

$$p, p_h = \text{const.} \quad \frac{\partial \omega}{\partial \tau} + \frac{\partial \omega}{\partial x} \frac{dx}{d\tau} + \frac{\partial \omega}{\partial y} \frac{dy}{d\tau} = 0 \quad (1.4)$$

on the basis of (1.1), the second condition can be put down as

$$\frac{\partial \omega}{\partial \tau} \frac{\partial \bar{z}}{\partial \tau} + \frac{\partial \omega}{\partial x} \frac{\partial \bar{z}}{\partial \tau} + \frac{\partial \omega}{\partial y} \frac{\partial \bar{z}}{\partial \tau} = 0 \quad (1.5)$$

In this equation, the horizontal line above marks the conjugate variable.

In order to solve the problem posed, we shall reflect conformally the area occupied by the liquid in motion upon some area expressed by the auxiliary complex variable $\zeta = \xi + i\eta$ in such a manner that the free surface will at all times coincide with the real axis. Designating the velocity functions, respectively, by $z = z(\zeta, t)$ and $\bar{z} = \bar{z}(\zeta, t)$, and transforming to the variables ζ and t , we have

$$\frac{\partial \omega(z, t)}{\partial \tau} = \frac{\partial \omega(\zeta, t)}{\partial \tau} + \frac{\partial \omega}{\partial \zeta} \zeta' \quad (\zeta' = \frac{\partial \zeta(z, t)}{\partial \tau})$$

Noting that, when $\zeta = \xi$ (on free surface):

$$\frac{\partial \omega(\zeta, t)}{\partial \tau} + \frac{\partial \omega(\zeta, t)}{\partial \zeta} = 0, \quad \frac{\partial \omega(\zeta, t)}{\partial \zeta} = - \frac{\partial \omega(\bar{\zeta}, t)}{\partial \bar{\zeta}}$$

CONFIDENTIAL



Figure 1.

Rewriting condition (1.5) as:

$$\frac{\partial \omega}{\partial \xi} - \frac{\partial \omega}{\partial \zeta} + m \frac{\partial \zeta}{\partial x} \frac{\partial \omega}{\partial \zeta} (\zeta - \bar{\zeta}) = 0$$

or, utilizing the equality

$$\zeta' = - \frac{\partial x}{\partial \xi} : \frac{\partial x}{\partial \zeta}$$

we have:

$$\frac{\partial \omega}{\partial \xi} - \frac{\partial \omega}{\partial \zeta} - m \left(\frac{\partial x}{\partial \xi} \frac{\partial \omega}{\partial \zeta} - \frac{\partial x}{\partial \zeta} \frac{\partial \omega}{\partial \xi} \right) = 0 \quad (1.6)$$

Introducing by I_m the ~~imaginary~~ ^{imaginary} part of the function, the above condition can be rewritten as:

$$m \cdot I_m \left(\frac{\partial x}{\partial \xi} \frac{\partial \omega}{\partial \zeta} \right) = - I_m \left(\frac{\partial \omega}{\partial \xi} \right) \quad (1.7)$$

Finally, on the basis of (1.3), (1.6), and (1.7), the following ~~conditions~~ ^{conditions}, which must hold on the free surface during the entire time of the action, are arrived at:

$$I_m \left(i \frac{\partial \omega}{\partial \xi} \right) = 0, \quad I_m \left(\frac{\partial x}{\partial \xi} \frac{\partial \omega}{\partial \zeta} \right) = - \frac{1}{m} I_m \left(\frac{\partial \omega}{\partial \xi} \right) + \frac{\kappa}{m} I_m \left(i \frac{\partial \omega}{\partial \xi} \right) \quad (1.8)$$

2. Let us consider the reduction in the level of ground waters under the ~~action~~ ^{action} exerted by a drainage pipe. Assuming that at the initial moment of time ($t = 0$), the level of the ground waters is horizontal, and coincides with the x-axis (Figure 1), while the ground waters occupy the entire lower semi-plane. Let us locate the center of the drainage basin on the y-axis at a fixed ~~point~~ ^{half} h_0 . Upon the expiration of time interval t , the level of the ground waters will be reduced, and will be represented

CONFIDENTIAL

by some curve hAC (Figure 1). We shall now reflect conformally the area below the curve hAC upon the lower ^{half} semi-plane of the ζ plane. point A in plane z will then become point A in plane ζ , with $\zeta = h_1$, where h is a variable that varies (and decreases) with time, and can be represented by the series

$$h = h_0 + h_1 t + h_2 t^2 + \dots \quad (2.1)$$

where $h_1, h_2, \dots$ are unknown constants to be determined. We shall present the ^{reflecting} ~~transforming~~ function as an ~~infinite~~ series in t :

$$w = \zeta + a_1 \left(\frac{\zeta}{h_1}\right) t + a_2 \left(\frac{\zeta}{h_1}\right) t^2 + \dots \quad (2.2)$$

where $a_1, a_2, \dots$ are the unknown functions, which are regular in the ^{half} ~~semi~~-plane $\eta > 0$, vanishing at infinity, and satisfying the ^{boundary} ~~boundary~~ conditions ^{obtained} from equation (1.6).

Let us now consider the construction of the function contained in (1.6). ^{On the basis of} ~~based on~~ the equalities

$$\left(\frac{\partial w}{\partial \zeta}\right)_{\zeta=\infty} = 1, \quad \left(\frac{\partial w}{\partial \zeta}\right)_{\zeta=\infty} = 0, \quad \frac{\partial w}{\partial \zeta} = \frac{\partial w}{\partial \zeta} + \kappa i \frac{\partial z}{\partial \zeta}$$

we find that

$$\left(\frac{\partial w}{\partial \zeta}\right)_{\zeta=\infty} = \kappa i \quad (2.3)$$

In addition, at point $\zeta = h_1$, this function has a pole of the first order expressed as $q/[2\pi(\zeta - h_1)]$, where q is the rate of discharge into the drain, that is, the amount of liquid flowing into the drain per unit time. This rate of dis-

CONFIDENTIAL

where depends on the difference in the pressures on the free surface of the liquid and the surface of the drain, and the duct radius, and is a function of time, which we will present in the form of a series

$$p = p_0 + p_1 t + p_2 t^2 + \dots \quad (2.4)$$

where $p_0, p_1, \dots$ are (unknown) constants, to be determined.

Taking into consideration the condition for $h \ll R$, we find that:

$$\frac{\partial v}{\partial z} = \kappa i - \frac{2}{R} \left(\frac{1}{z + ih} - \frac{1}{z - ih} \right) \quad (2.5)$$

Let us return to the boundary condition (1.1). We shall first reduce it to a form containing only the functions, which are regular in the half-plane $\eta > 0$. Note that

$$I_m \frac{1}{z + ih} = -I_m \frac{1}{z - ih} \quad \text{for } z = \xi$$

we will have, when $\xi = \xi$,

$$I_m \frac{\partial w}{\partial \xi} = \kappa + I_m W, \quad \text{where } W = \frac{2}{\pi(\xi + ih)} \quad (2.6)$$

Now, condition (1.5) can be written as

$$I_m \left(\frac{\partial z}{\partial t} \frac{\partial z}{\partial \xi} \right) = -\frac{\kappa}{m} - \frac{1}{m} I_m W + \frac{\kappa}{m} I_m \left(i \frac{\partial z}{\partial \xi} \right) \quad (2.7)$$

On the basis of used on (2.2), (2.4), (2.5) and (2.6), and after opening the parentheses, we have the expansion

$$\frac{\partial z}{\partial \xi} = z_1 + 2z_2 t + 3z_3 t^2 + \dots, \quad \frac{\partial z}{\partial \xi} = 1 + \frac{\partial z_1}{\partial \xi} t + \frac{\partial z_2}{\partial \xi} t^2 + \dots$$

$$W = W_0 + W_1 t + W_2 t^2 \quad (2.8)$$

$$\text{where } W_0 = \frac{2}{\pi(\xi + ih)}, \quad W_1 = \frac{2}{\pi} \left[\frac{g_1}{\xi + ih} - \frac{i g_0 h_1}{(\xi + ih)^2} \right]$$

$$W_2 = \frac{1}{\pi} \left[\frac{g_2}{\xi + ih} - \frac{i g_1 h_1 + i g_0 h_2}{(\xi + ih)^2} - \frac{g_0 h_1^2}{(\xi + ih)^3} \right],$$

CONFIDENTIAL

CONFIDENTIAL

Substitution these series into (2.7) and comparing the coefficients of terms with the same powers of t , we will obtain a system of boundary conditions for the determination of the functions $z_1(z)$, $z_2(z)$, ... Thus, for z_1 the condition will have the form

$$I_n z_1 = -\frac{1}{n} I_n W_1 \quad (2.9)$$

Since functions z_1 and W_1 are regular in the plane $\eta = 0$, and vanishes when $z \rightarrow \infty$, we immediately find from (2.9) that

$$z_1 = -\frac{1}{n} W_1 = -\frac{1}{n} \frac{1}{z} \quad (2.10)$$

Then, to determine z_2 , when $\zeta = \frac{1}{z}$, we have

$$I_n(z_1) + I_n(z_2) = -\frac{1}{n} I_n W_1 + \frac{1}{n} I_n \ln\left(\frac{z}{y}\right) \quad (2.11)$$

Assuming that $z_2 = z_{21} + z_{22}$, we will break it down into two conditions:

$$I_n(z_{21}) = -\frac{1}{n} I_n W_1 + \frac{1}{n} I_n \left(i \frac{z}{y}\right) \quad (2.12)$$

From (2.11) we immediately find that

$$z_{21} = -\frac{1}{2n} W_1 + \frac{1}{2n} \frac{1}{y} = -\frac{1}{2n} \frac{1}{z} + \frac{1}{2n} \frac{(nh + K)}{(z + h)^2} \quad (2.13)$$

Into this expression entered the constants q_0 , q_1 , and h_1 , which have to be determined. To do this, we shall utilize the condition that, we must have when $\zeta = ih$, then $z = h_0 i$:

$$h_0 i = z(ih) = ih + z_1(ih) + z_2(ih) + \dots \quad (2.14)$$

CONFIDENTIAL

CONFIDENTIAL

But

$$z_2(ih) = \frac{g_0}{2m\pi} \frac{1}{ih + \epsilon h_0} = \frac{i g_0}{2m\pi h_0} \frac{1}{2 + (h_3/h_0)t + (h_4/h_0)t^2 + \dots} = \frac{i g_0}{2m\pi h_0} - \frac{i g_0 h_3}{4m\pi h_0^2} t + \dots$$

Therefore, (2.14) gives the expression

$$h_3 t = \epsilon (h_0 + h_3 t + \dots) + \frac{i g_0}{2m\pi h_0} - \frac{i g_0 h_3}{4m\pi h_0^2} t + \dots$$

Equating the coefficient of t to zero, we find that:

$$h_3 = - \frac{g_0}{2m\pi h_0} \quad (2.15)$$

Let us now determine the value of q_0 and q_1 . From (2.5), by integration we find:

$$W = P_k + \kappa \epsilon + \frac{g}{2\pi} \log \frac{\epsilon + ih}{\epsilon - ih} \quad (2.16)$$

where $P_k = -p_k/\gamma$, and P_k is the pressure on the ~~center~~ of the area, that is, on the free surface. At the points in the drain pipe surface, where it may be assumed that $z = ih_0 + \delta e^{i\theta}$, the pressure equals a constant value p_0 . In ~~the~~ particular ~~case~~, we have $p = p_0$ at point $z = ih_0 + \delta$; that is, when $\theta = 0$. Since

$$\zeta(ih_0 + \delta) = \zeta(ih_0) + i \frac{\partial \zeta}{\partial z} \delta + \dots$$

then, at the point in the drain pipe ~~where~~ $z = ih_0 + \delta$, we have

$$W_m \approx P_k + \kappa \epsilon \left[ih + \frac{\delta}{(\partial z / \partial \zeta)_{ih}} \right] + \frac{g}{2\pi} \log \frac{\partial \zeta / \partial z}{(\partial \zeta / \partial z)_0}$$

From this, taking into account that

$$\left(\frac{\partial \zeta}{\partial z} \right)_{ih} = \frac{1}{(\partial z / \partial \zeta)_{ih}}$$

we obtain

$$[Re: "real part of"] \quad P_m = R_e W_m = P_k - \kappa h_0 + \frac{g_0}{2\pi} \log \frac{\epsilon h_0}{\delta} \quad (2.17)$$

From here we find the initial drain pipe discharge

$$(2.16)$$

W. G. G.

$$\Delta p = p_K - p_m, \quad \frac{K}{K_0} = \frac{k}{\gamma} \quad (2.12)$$

If, in the equation for W_{ij} , we ~~bring together all~~ ^{collect} the terms containing t in the first power, we find that

$$f_2 = \frac{g_2(x_2, y_2) - f_1(x_2, y_2)}{h_2(x_2, y_2)} \quad (2.9)$$

Now, the equation (2.13) is fully determined for u_{21} .

We will now determine z_{22} by equation (2.12). We will
 reduce it ~~to a function of z_{11}~~ the right member contains ~~the~~ ³ function ~~which~~
~~is~~ regular in the ~~real plane~~ ^{real} $y=0$. ~~the value of that~~ ^{the} ~~Integ~~

[illegible]

therefore, from (2.12) we obtain

[illegible]

Utilising the fact that $I_n[f(x)] = I_n[f(x)]$

When $\alpha = 1$, we re-write the last equation as:

$$I_m(R_{z_0}) = \frac{g_0^2}{2m^2\pi^2k_0^2} I_m \left[\frac{1}{2(\epsilon_0^2 + i\epsilon_0)} - \frac{1}{\epsilon_0^2 + i\epsilon_0} + \frac{1}{\epsilon_0^2 + i\epsilon_0} \right] =$$

From this, we find g_0 :

$$\epsilon_2 = \frac{q^2}{4m^2\pi^2\hbar^2} \left[\frac{1}{\epsilon + i\hbar} - \frac{1}{(\epsilon + i\hbar)^2} \right] \quad (2.21)$$

CONFIDENTIAL

Adding (2.13) and (2.21), we find

$$z_1 = -\frac{1}{(2m\pi h_0)^2} \left[\frac{\beta_0^2 + 2m\pi^2 h_0^2}{\zeta + i h_0} + i \beta_0 h_0 \frac{(\beta_0 - 2K\pi h_0 - 2m\pi^2 h_0^2)}{(\zeta + i h_0)^2} \right] \quad (2.22)$$

In a similar manner, we compute the following coefficients of the ~~expansion~~ ⁱⁿ powers of ζ :

$$z_3 = -\frac{A}{\zeta + i h_0} - \frac{1B}{(\zeta + i h_0)^2} + \frac{2C}{(\zeta + i h_0)^3} \quad (2.23)$$

$$A = \frac{2\beta_0}{(2m\pi)^2 h_0^2} \left[\beta_0 (\beta_0 - K\pi h_0) + m\pi (\beta_0 h_0 - \beta_0^2 h_0) \right] + \frac{9\beta_0}{5\pi}$$

$$B = \frac{2\beta_0}{(2m\pi)^2 h_0^2} \left[h_0 (\beta_0 - K\pi h_0) + m\pi (\beta_0 h_0 - \beta_0^2 h_0) \right] \cdot \frac{K(\beta_0^2 + 2m\pi^2 h_0^2)}{8 h_0^2 (2m\pi)^2} - \frac{\beta_0 h_0 + \beta_0^2 h_0}{5\pi}$$

$$C = \frac{\beta_0}{(2m\pi)^2 h_0^2} (\beta_0 - 2m\pi^2 h_0) (\beta_0 - 2K\pi h_0 - 2m\pi^2 h_0) + \frac{\beta_0 h_0^2}{5\pi}$$

In order to follow the ~~displacement~~ ^{displacement} in time, of the point A in the free surface, let us assume $\zeta = 0$ in equations (2.10), (2.22), (2.23) for z_1 , z_2 , and z_3 . We will then find the approximated expression for z_A y_A :

$$y_A = \frac{\beta_0}{m\pi h_0} \zeta + \frac{\beta_0^2 + m\pi (\beta_0 h_0 - \beta_0^2 h_0) - 2K\pi \beta_0 h_0}{2m\pi^2 h_0^2} \zeta^2 + \left(\frac{A}{h_0} + \frac{B}{h_0^2} + \frac{2C}{h_0^3} \right) \zeta^3 + \dots \quad (2.24)$$

Let us consider now the expression for the discharge of the drainpipe (2.4). For q_0 and q_1 we had the formulas (2.18) and (2.20) respectively. ~~and now~~ We derive further:

$$\frac{q_1}{q_0} = \frac{2h_0}{8} = \frac{\beta_0 (2\beta_0 - 4K\pi h_0)}{8m\pi h_0^2} + \frac{\beta_0^2 (27\beta_0 - 28K\pi h_0)}{8(2m\pi)^2 h_0^2} + \frac{(K\pi)^2 \beta_0}{(2m\pi)^2 h_0^2} \quad (2.25)$$

From equation (2.18) for q_0 it can be seen that when the drop in pressure ^{is zero} $\Delta p = 0$, then q_0 is still other than zero, since the motion takes place by the force of gravity. The expression

CONFIDENTIAL

UNCLASSIFIED

Adding (2.13) and (2.21), we find

$$z_1 = -\frac{1}{(2m\pi h_0)^2} \left[\frac{g_0^2 + 2m\pi g_0 h_0^2}{\zeta + ih_0} + \frac{g_0 h_0 (g_0 - 2\pi h_0 - 2m\pi h_0^2)}{(\zeta + ih_0)^2} \right] \quad (2.22)$$

In a similar manner, we compute the following coefficients of the ~~expansion~~ ⁱⁿ powers of t :

$$z_3 = -\frac{A}{\zeta + ih_0} - \frac{1B}{(\zeta + ih_0)^2} + \frac{2C}{(\zeta + ih_0)^3} \quad (2.23)$$

$$A = \frac{2g_0}{(2m\pi)^2 h_0^2} \left[g_0 (g_0 - \pi h_0) + m\pi (g_0 h_0 - g_0^2) \right] + \frac{g_0^2}{3\pi}$$

$$B = \frac{g_0}{(2m\pi)^2 h_0^2} \left[g_0 (g_0 - h_0^2) + m\pi (g_0 h_0 - g_0^2) \right] \cdot \frac{h_0 (g_0^2 + 2m\pi g_0 h_0^2)}{3 h_0^2 (2m\pi)^2} - \frac{g_0 h_0 + g_0^2 h_0}{3\pi}$$

$$C = \frac{g_0}{(2m\pi)^2 h_0^2} (g_0 - 2\pi h_0) (g_0 - 2\pi h_0 - 2m\pi h_0^2) + \frac{g_0 h_0^2}{3\pi}$$

In order to follow the ~~displacement~~ ^{displacement} in time, of the point A in the free surface, let us assume $\zeta = 0$ in equations (2.10),

(2.22), (2.23) for z_1 , z_2 , and z_3 . We will then find the approximate expression for z_A :

$$y_A = \frac{g_0}{m\pi h_0} t + \frac{g_0^2 + m\pi (g_0 h_0 - g_0^2) h_0 - 2\pi g_0 h_0^2}{2m\pi^2 h_0^3} t^2 + \left(\frac{A}{h_0} + \frac{B}{h_0^2} + \frac{2C}{h_0^3} \right) t^3 + \dots$$

Let us consider now the expression for the discharge of the drainpipe (2.4). For q_0 and q_1 we had the formulae (2.18) and (2.20) respectively. ~~and now~~ We derive further:

$$q_1 \cdot \frac{2h_0}{g} = \frac{g_0 (7g_0 - 4\pi h_0)}{8m\pi h_0^2} + \frac{g_0^2 (27g_0 - 28\pi h_0) + (\pi h_0^2) g_0}{8(2m\pi)^2 h_0^3} \quad (2.25)$$

From equation (2.18) for q_0 it can be seen that when the drop in pressure $\Delta p = 0$, then q_0 is still other than zero, since the motion takes place by the force of gravity. The expression

CONFIDENTIAL

Consequently

(2.20) for q_1 may be either positive or negative. Also, for the moments in time close to the initial moment, the discharge q may be either increasing or diminishing. Let us set up:

$$F = \frac{2}{2\pi\kappa} \sqrt{\log \frac{2h_2}{\delta} (2\delta - 4\kappa\pi h_2)_{h_2,1}} = 3 + 3\frac{\Delta p}{\gamma} - 2\sqrt{\frac{2}{\delta}}$$

kg.cm⁻³

Assuming $\gamma \approx 0.001 \text{ kg.cm}^{-3}$, we find the following table schedule of values δ (the radius of the drain pipe) when for which

 $F_1 = 0$:

$\Delta p : 0$	0.001	0.002	0.003
$\delta : 0.45$	0.11	0.022	0.005

when $\delta > \delta_1$, $\delta_1 > 0$.

Received by Editorial Staff

12 June 1946

The Institute
of Mechanics

Academy of Sciences,

USSR

BIBLIOGRAPHY

Non-stationary

1. P. Ya. Polubarinova-Kochina, "Unsolved Problems in the Theory of Filtration, PMM [Applied Mathematics and Mechanics] (1945) Volume IX, pages 79 - 90.

E N D

CONFIDENTIAL

Ministry of Foreign AffairsSTORTING PROPOSAL NO 58

(1950)

On the procurement of the Storting's assent to the ratification of the agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary and on the result of the work on the adjustment of conflicts and incidents on the boundary:

INTRODUCED BY THE STORTING AS A PROPOSAL TO THE PARLIAMENT

AND APPROVED BY THE STORTING AS A PROPOSAL TO THE PARLIAMENT

Presented by Foreign Minister Halvard M. Lange.

The Norwegian-Soviet boundary from the tri-state boundary station on Kinnfjell Mountain to the mouth of the Lovatzen River in the Arctic Ocean was surveyed and marked in the summer of 1947 by a joint Norwegian-Soviet boundary commission. At the conclusion of the boundary survey the two delegations went to Moscow where they reviewed the material which had been prepared during the boundary survey, and the final documents were signed on 19 December 1947. Through the Government resolution of 17 September 1948 a bill was brought before the Storting for the procurement of the Storting's assent to Norwegian approval of the documents (Storting Proposal No 119, 1948). The Storting gave its assent to the approval of the documents on 3 December 1948 (cf. Storting Report No 250, 1948).

Through the Government resolution of 10 December 1948, the Ministry of Foreign Affairs was given the authority to exchange notes on the approval of the documents of the boundary survey. The exchange of notes took place in Moscow on 23 May 1949, and the documents went into effect the same day.

During the preliminary negotiations of the two delegations in Moscow in the fall of 1946, a regulation was adopted as an attachment to Protocol No 3 for the marking of the international boundary between the USSR and Norway by the joint Soviet-Norwegian commission. Point I of this regulation -- in which the joint commission's duties were more closely defined -- states:

"The setting up of instructions for the constant inspection and supervision of the boundary markers and the boundary strips [grensegatene] along the demarcated frontier."

However, this point was amended during the commission's negotiations in Oslo in the spring of 1947 and the following formulation was provided:

"Preparation of a draft for the agreement on the adjustment of boundary disputes and, similarly, a draft for the agreement on the administration of the Norwegian-Soviet border, and the presentation of these drafts to the Governments of Norway and of the Soviet Union for their final decision."

The protocol of the meeting where the question was discussed states the following concerning this amendment:

"On a motion by the Soviet Delegation, the Commission resolved to replace the previously proposed draft of instructions for the constant inspection and supervision of the boundary markers along the international boundary between Norway and the USSR with a draft for an agreement on the same subject."

"The Soviet Delegation will prepare a draft for the above-mentioned agreement and will include in it the main points of the previously proposed instructions. The draft for this agreement will be subject to debate by the joint Commission and will be presented in its final form to the Governments of Norway and the USSR for deliberation when the surveying is completed."

"The chairman of the Soviet Delegation stated that the Soviet group would prepare a draft for the agreement on the solution of disputes (incidents) on the international boundary between Norway and the USSR which would later be submitted for review upon completion of the survey."

In connection with the Commission's resolution referred to above, the chairman of the Soviet Delegation, Counsellor of the Embassy Mayevskiy, during a meeting on 27 December 1947 in Moscow, submitted a Soviet draft to the Norwegian delegation for the agreement on the method of procedure to be taken in adjusting conflicts and border incidents. Later, on 4 June 1948, a representative of the local Soviet Embassy submitted a letter to the Ministry of Foreign Affairs from Counsellor of the Embassy Mayevskiy dated 20 May 1948 and addressed to the chairman of the Norwegian Delegation, Pylke Governor [Norwegian Provincial Governor] Gabrielsen. Attached to the letter was a Soviet draft for a so-called "regime agreement," that is, an agreement on the inspection and supervision of boundary markers and boundary strips, together with regulations on floatage, fishing, and traffic on boundary waterways, hunting in the border regions, etc.

Upon delivery of the draft of the agreement on conflicts and incidents along the boundary and in the letter of 20 May 1948 to Pylke Governor Gabrielsen, Counsellor of the Embassy Mayevskiy stated that he assumed the Norwegian side would prepare written remarks on the two drafts before oral negotiations were opened between the two countries.

The Ministry of Foreign Affairs subsequently procured statements concerning the two Soviet drafts from the War Office and the Department of Justice, as well as from the chairman and the members of the previous Norwegian boundary delegation. The draft for the "regime agreement" was also laid before the Department of Agriculture and the Department of Industry (the Mining Office and the Section for Water and Electric Power, each of which gave its opinions. Further-

"The chairman of the Soviet Delegation stated that the Soviet group would prepare a draft for the agreement on the solution of disputes (incidents) on the international boundary between Norway and the USSR which would later be submitted for review upon completion of the survey."

In connection with the Commission's resolution referred to above, the chairman of the Soviet Delegation, Counsellor of the Embassy Mayevskiy, during a meeting on 27 December 1947 in Moscow, submitted a Soviet draft to the Norwegian delegation for the agreement on the method of procedure to be taken in adjusting conflicts and border incidents. Later, on 4 June 1948, a representative of the local Soviet Embassy submitted a letter to the Ministry of Foreign Affairs from Counsellor of the Embassy Mayevskiy dated 20 May 1948 and addressed to the chairman of the Norwegian Delegation, Fylke Governor [Norwegian Provincial Governor] Gabrielsen. Attached to the letter was a Soviet draft for a so-called "regime agreement," that is, an agreement on the inspection and supervision of boundary markers and boundary strips, together with regulations on floatage, fishing, and traffic on boundary waterways, hunting in the border regions, etc.

Upon delivery of the draft of the agreement on conflicts and incidents along the boundary and in the letter of 20 May 1948 to Fylke Governor Gabrielsen, Counsellor of the Embassy Mayevskiy stated that he assumed the Norwegian side would prepare written remarks on the two drafts before oral negotiations were opened between the two countries.

The Ministry of Foreign Affairs subsequently procured statements concerning the two Soviet drafts from the War Office and the Department of Justice, as well as from the chairman and the members of the previous Norwegian boundary delegation. The draft for the "regime agreement" was also laid before the Department of Agriculture and the Department of Industry (the Mining Office and the Section for Water and Electric Power, each of which gave its opinions. Further-

more, Professor Carstberg made a number of remarks concerning the draft for the agreement on conflicts and incidents on the border.

Through the Government Resolution of 24 September 1948, a commission was appointed to prepare the negotiations with the USSR on this boundary question. The commission was composed of the following:

Fylke Governor H. Gabrielsen, chairman
Colonel A. Wettre (War Office)
Chief Engineer O. Mengsboel (Main Directorate of the Norwegian Watercourse and Electric Power Supply Office)
Office Chief J. S. Rødten (Department of Agriculture)
Bureau Director E. A. Colban (Ministry of Foreign Affairs)
Office Director P. Horthøy (Department of Justice)
Secretary S. Gjellum (Ministry of Foreign Affairs), secretary

Through the Government resolution of 29 October 1948, Director of Waterways Jobs. Johannesen was attached to the commission.

The commission gave its report on 30 November 1948, and presented a Norwegian counter-proposal for the agreement, in one document, on those questions which the Soviet side had suggested handling in two agreements.

This Norwegian draft was submitted to the War Office, the Department of Justice, the Department of Agriculture, and the Department of Industry for a decision. None of these departments had any pertinent remarks to make on the draft.

Subsequently the draft was sent to the Ministry of Foreign Affairs of the USSR.

After the Ministry of Foreign Affairs had been informed that the USSR was willing to handle all the problems in question in a single agreement and that everyone was prepared to begin negotiations on the same basis, the following delegation was appointed by the government resolution of 1 September 1949 to negotiate with the Soviet Delegation:

By the Governor H. Gabrielsen, chairman.

Minister Director E. A. Soltan (Department of Foreign Affairs).

Secretary Per Nilsson (Ministry of Foreign Affairs), secretary.

The two delegations met on 1 October 1949. The delegation to the USSR was assisted by the Norwegian Consulate in Moscow. The delegation to the USSR was assisted by the Norwegian Consulate in Moscow.

At the first meeting, the two delegations discussed the Norwegian proposal for a single agreement. The Soviet delegation was represented by the Soviet Minister of Foreign Affairs, Vyacheslav Molotov.

The Soviet delegation made its decision on 2 November 1949. It concluded that the Norwegian proposal was acceptable. The Soviet delegation was represented by the Soviet Minister of Foreign Affairs, Vyacheslav Molotov. The Norwegian delegation was represented by the Norwegian Minister of Foreign Affairs, Einar M. Haugen. The two delegations met on 2 November 1949. The Soviet delegation was assisted by the Soviet Consulate in Oslo. The Norwegian delegation was assisted by the Norwegian Consulate in Moscow.

The first meeting between the delegations was held on 3 November 1949. At this meeting, the Soviet delegation was represented by the Soviet Minister of Foreign Affairs, Vyacheslav Molotov. The Norwegian delegation was represented by the Norwegian Minister of Foreign Affairs, Einar M. Haugen. The two delegations met on 3 November 1949. The Soviet delegation was assisted by the Soviet Consulate in Oslo. The Norwegian delegation was assisted by the Norwegian Consulate in Moscow.

On the basis of this new Soviet draft, negotiations were continued until 2 December. The result of the negotiations was that on 20 December 1949, the chairmen of the two delegations signed an Agreement between

the Royal Norwegian Government and the Government of the USSR on various aspects of the Norwegian-Soviet border and on the method of procedure in adjusting boundary disputes and conflicts with attached protocols and a final protocol. Fylke Governor Gabrielsen signed pursuant to the authorization granted in the Government Resolution of 12 December 1949. The agreement was drawn up in Norwegian and Russian. The Norwegian text is attached (Attachment 1).

The agreement is divided into five chapters. Chapter I (Articles 1-6) deals with the course of the boundary line, as well as with boundary markers and boundary ^{ships} firebreaks. The course of the boundary line is defined in accordance with the boundary documents which were signed in Moscow on 18 December 1947. The care and maintenance of the boundary markers and boundary ^{ships} firebreaks is to be divided equally between the two parties so that each party is responsible for certain definite boundary markers. Each year the representatives of the parties are to undertake a joint inspection of the boundary markers and boundary ^{ships} firebreaks.

Chapter II (Articles 7-15) contains regulations concerning boundary waters and their use (shipping, floatage, fishing). Ships have the right to follow the main channel in rivers and the narrow parts of lakes even though the boundary line may not follow it. Otherwise, ships have only the right to pass up to the boundary line. Ships carrying timber have the right to cross the boundary line while traveling on lakes and rivers (Article 8).

Article 9 takes up special definitions for night traffic on frontier waterways. In addition, it is stated that all vessels are to be numbered and identified by a flag.

Article 10 insures both parties the right to unhindered floatage of timber, and Article 11 contains rules permitting floatage vessels to

cross the waterway and move along the opposite shore.

Article 13 insures the right of the inhabitants of the two countries to fish up to the boundary line. Use of explosives, poison, and drugs, as well as spearing is prohibited.

Article 14 stipulates that the parties are to take necessary steps to prevent damages to the shores of the boundary rivers and lakes, and that questions connected with the erecting and operating of all types of installations or constructions on the Pasvikely or Jakobely rivers and their tributaries, which might affect the water level or the traffic on these rivers must be settled through special talks between the parties.

In Article 15 the parties pledge themselves as far as possible to exchange such information on the water level, the traffic, and the ice situation in boundary waters as might serve to prevent damage or danger which could arise as a result of high water or the breaking of ice.

Chapter III (Articles 16-18) contains regulations on hunting, agriculture, and mining. These regulations all aim to insure that activities of this type are handled in such a manner that they do not cause damage on the territory of the other party.

Chapter IV (Article 19) deals with conflicts and incidents on the border. In this chapter the parties pledge themselves to take the necessary measures to prevent conflicts and incidents which might arise on the border, and to investigate and settle them. Several examples of action which can be regarded as conflicts and incidents on the border are then enumerated. Among these are shooting or acts of violence across the border; affrontery or insulting actions on the border against the other party; all kinds of unlawful trespassing or flying across the border; discovery of objects which have drifted across the border; moving, damaging or destruction of boundary markers; photographing of the other party's

border territory; and, stealing, damaging or destruction of private property. There are regulations concerning reindeer, domestic animals, and poultry which stray across the border; fires which spread across the border; and conversations and other intercourse across the boundary line.

This chapter furthermore includes regulations concerning the handling of compensation claims which arise in connection with conflicts and incidents on the border.

Chapter V (Articles 20-37) contains regulations covering border authorities, their area of activity, and rules for the crossing of the border.

The agreement envisages that each party will appoint a boundary commissioner with a deputy and assistants. The boundary commissioners are to be the parties' agents for fulfilling the conditions of the agreement, and they are to cooperate with each other on all questions which, according to the agreement, concern both parties. In this chapter there is a closer definition of the conditions under which this cooperation should take place and under what circumstances the boundary commissioners and their assistants can cross the border. The boundary commissioners and their people are guaranteed personal inviolability and inviolability for those official papers they carry during a border transgression.

The concluding regulations are to the effect, among other things, that the agreement is to be valid for five years, but that it can be terminated before the expiration of this time with six months advance notice. If it is not terminated, it is automatically to remain valid for each successive five-year period.

The agreement is to be ratified with as little delay as possible, and it is to go into effect as soon as the ratification documents are exchanged.

The Norwegian delegation has made a report to the Ministry of Foreign Affairs on the negotiations, dated 29 January 1950. The report is attached as an unpublished enclosure.

The report reveals that one of the points which was rather extensively discussed during the negotiations was the problem of the water level and water traffic in the Pasvik waterway. The fact is that in recent years there have been known to be sudden drops in the water level of the Pasvikelv River on the one hand, and sudden floods on the other, both of which have caused a nuisance to the local population. It has been assumed that these conditions have some connection with the Soviet damming of the waterway in the vicinity of Enaresjø Lake. The report has this to say about it:

"The question of the water traffic and the water level in the Pasvik waterway, which the Norwegian side had hoped to have more closely defined in this agreement, was discussed at the meeting between the delegation on 2 December in connection with the heading of Chapter II of the agreement. It became evident at this point that the Soviet side definitely opposed the inclusion in this agreement of general rules on water traffic rights or the utilization of water power. According to the Soviet side, the negotiations ought to be taken up along with the agreement which the Soviet draft of Article 14 assumed could be concluded.

"During the discussion of this article at the meeting between the delegation on 6 December 1949, Fylke Governor Gabrielsen informed that the Norwegian side had no objection to concluding such an agreement as suggested by the Soviet side, but since it might take some time before such a waterway agreement could be drawn up, it would be practical to establish certain general principles on waterway rights, namely in the present agreement.

"This question had been discussed in advance by the Norwegian delegation together with representatives from the Department of Agriculture and the Waterways Authority, together with Fleotage Director Johannessen."

"However, the Soviet delegation was quite unwilling to include such a general decision in the agreement, since according to them no decision could be established in this agreement on questions which would later be handled in a separate agreement. It would in that case tie down those who were to negotiate the later agreement."

"After lengthy discussions the Norwegian delegation felt that it should limit itself to the establishment of a general agreement prohibiting contamination and preventing damage to the shores of the waterways, and providing for regular exchange of information on the water level, the ice situation, etc."

"In addition, it was established that questions connected with the erecting as well as the operating of installations or constructions which might influence the water level and the water traffic, should be dealt with in separate agreements."

The agreement was drawn up in Norwegian and Russian and the negotiations were conducted with the aid of interpreters. Constant difficulties therefore arose in finding expressions in the two languages which corresponded to each other. In the report of the delegation, the following is mentioned in this connection:

"During the negotiations the necessity of using a form of language that brought the two texts as close to each other as possible was constantly emphasised. In order to obtain a wording which met this desire to the greatest possible extent, the Norwegian side found it necessary to use expressions which do not correspond too closely with the rules for

good Norwegian, since editing would bring the texts as far from each other as to make comparison difficult. This point was strongly emphasized, particularly by the Soviet side. Since the two languages are so different from each other, both in vocabulary and sentence construction, a critical study of the Norwegian text will readily reveal grammatical errors which might seem unnecessary and somewhat awkward. However, the Norwegian delegation was of the opinion that purely grammatical considerations ought to be secondary when one takes into consideration the importance of reaching a final decision on the many real problems which the agreement contains."

The USSR has settled its boundary relations with other neighboring countries in a series of agreements similar to that with which we are here concerned. Among others, Finland and Poland have concluded such agreements with the USSR.

In order to standardize conditions in the border regions of the northeast, as well as to reestablish standard economic conditions in regard to floatage, shipping, and fishing in the boundary waterways in question, the Ministry of Foreign Affairs has deemed it necessary to conclude such an agreement as we are here concerned with. This agreement will lead to the establishment of fixed rules for the handling of all boundary disputes, etc., and the establishment of fixed organs on both sides which will remain in contact with each other.

In order that the agreement may be realized it will be necessary to issue certain new statutory provisions. Proposals for such statutory provisions will be submitted together with this proposal.

The Ministry of Foreign Affairs desires

that Your Majesty approve and sign a draft of a proposal to the

Starting on the content to the ratification of an Agreement between the Royal Norwegian Government and the Government of the USSR regarding various aspects of the Norwegian-Soviet boundary, and on the methods of procedure in adjusting boundary conflicts and incidents.

We HAAKON, King of Norway,

hereby proclaim:

The Storting is invited to resolve that the Agreement between the Royal Norwegian Government and the Government of the USSR on various aspects of the Norwegian-Soviet boundary and on methods of procedure in adjusting boundary conflicts and incidents be ratified from the Norwegian side.

Affirmation from the Ministry of Foreign Affairs is attached.

Done at Oslo Castle, 24 March 1950

Under our hand and the seal of the realm

HAAKON
(L.S.)

Leif Gierne

Einar Gerhardsen

AGREEMENT

between the Royal Norwegian Government and the Government of the USSR on various aspects of the Norwegian-Soviet boundary and on methods of procedure in the adjustment of boundary conflicts and incidents.

The Royal Norwegian Government on the one side and the Government of the USSR on the other, desiring to enact a resolution for controlling conditions on the Norwegian-Soviet border and for preventing conflicts and incidents from arising on the border, and in case they do arise, to

insure a prompt investigation and adjustment of them, have decided to conclude this agreement, and for this purpose have named the undersigned to act as their plenipotentiaries, who, after showing their credentials which are found to be in good and correct form, are in agreement on the following:

CHAPTER I

Course of the Boundary Line; Maintenance of Boundary Markers and *Boundary*
Stripes

Article 1

1. The boundary line between Norway and the USSR as named in this agreement is the line which traverses the terrain as it is established in the boundary marking documents which were signed in *Moscow* on 18 December 1947 by the *Joint* Soviet-Norwegian Commission for Marking the *International* Boundary between the USSR and Norway, and which were approved by the Government of Norway and the Government of the USSR. In the present agreement this line is called the "boundary" or "boundary line."

2. The boundary line established and described in the above-named documents also bounds the space in a vertical direction, in the air and under the ground.

Article 2

The contracting parties assume the obligation of keeping the boundary markers which are set up to indicate the boundary line between Norway and the USSR and also the boundary *stripes* firebreaks in such condition that the location, the type and form, the measurements and painting on boundary markers, and the width and maintenance of boundary *stripes* firebreaks fulfill all the requirements stated in the boundary marking documents.

Article 3

The maintenance of boundary markers and *Boundary* *Stripes* firebreaks is divided be-

between the contracting parties in the following manner:

1. The maintenance of the boundary markers and those parts of the boundary ~~firebreaks~~ ^{strips} which are on Norway's territory shall be handled by the Norwegian ~~side~~.

2. The maintenance of the boundary markers and those parts of the boundary ~~firebreaks~~ ^{strips} which are on the territory of the USSR shall be handled by the Soviet ~~side~~.

3. The maintenance of the boundary markers which are set up on the boundary line itself shall be handled by:

- (a) the Norwegian ~~side~~ for markers which have uneven numbers.
- (b) the Soviet ~~side~~ for markers which have even numbers.

Article 4

1. Inspection of the condition and position of the boundary markers and the condition of the boundary ~~firebreaks~~ ^{strips} shall be done at the discretion of the proper authorities of the contracting parties according to the terms of Article 3. In addition to the unilateral inspection, representatives for the proper authorities of both contracting parties shall each year undertake a joint inspection of the boundary markers and ~~firebreaks~~ ^{strips}.

2. The joint inspection shall be undertaken in the month of August. The proper authorities of the contracting parties shall each time agree on when the joint inspection is to begin.

3. Should it be necessary to undertake a joint supplementary inspection of the boundary markers and ~~firebreaks~~ ^{strips} in the course of the same year, the proper authorities of one of the contracting parties shall give written notice of this to the proper authorities of the other contracting party. The joint supplementary inspection is to be undertaken not later than 10 days after the proper authorities of the

other contracting party have been notified.

The result of the inspection undertaken by the representatives of the proper authorities of the contracting parties shall be embodied in a report in four copies, of which two copies are to be in Norwegian and two in Russian.

Article 5

1. If a boundary marker disappears, is destroyed, or is damaged, it is immediately to be set up again or repaired by the proper authorities of the party upon whose territory it stands or under whose supervision it belongs in accordance with Article 3. The proper authorities of the one contracting party assume the obligation to inform the proper authorities of the other contracting party in writing at least 10 days before the work of replacing or repairing the boundary markers is to begin.

2. The replacing or repairing of boundary markers which have disappeared, are destroyed, or are damaged shall be undertaken by the proper authorities of the concerned party in the presence of representatives for the proper authorities of the other party. When a boundary marker is replaced, the representatives for the proper authorities of both parties are to make a report in 4 copies, of which 2 are to be in Norwegian and 2 in Russian. New boundary markers which are set up are to correspond with the specifications established in the boundary documents of 1947.

3. If no traces remain as to the proper location of the boundary marker which disappeared, the proper authorities of both contracting parties, when replacing it, assume the obligation to follow the boundary marker documents of 1947.

4. The work of maintaining the boundary markers which are under the supervision of one or the other party as defined in Article 3, is to be undertaken independently by each of the contracting parties without

participation by representatives of the proper authorities of the other party.

5. The contracting parties shall make all necessary efforts to protect the boundary markers and shall hold any person responsible who is found guilty of moving, damaging, or destroying the boundary markers. In such cases the damage to or destruction of a boundary marker which is caused by the inhabitants of one party shall be repaired at the expense of that party.

Article 6

1. The boundary ~~firebreaks~~ ^{strips} which are 8 meters wide (4 meters on either side of the boundary line) shall be kept in complete repair and, when necessary, shall be cleared of bushes and scrub which hinder visibility.

2. The construction of buildings of any kind in the ~~firebreaks~~ ^{strips} is forbidden. Persons guilty of this shall be held responsible.

3. Each of the parties shall clear the boundary firebreaks on ~~their~~ ^{his} own territory. The proper authorities of the contracting parties shall notify each other of any forthcoming work on the boundary ~~firebreaks~~ ^{strips} at least 10 days before the operations begin. Representatives of the proper authorities of the other contracting party has the right to be present during such work.

CHAPTER II

Boundary waterways and rules for their use (maritime traffic, floatage, fishing).

Article 7

1. By boundary waterways in this agreement is meant the Parvikely River (Patee-joki) with the two lakes it forms from boundary marker Number 104, and the Jankosely River.

participation by representatives of the proper authorities of the other party.

5. The contracting parties shall make all necessary efforts to protect the boundary markers and shall hold any person responsible who is found guilty of moving, damaging, or destroying the boundary markers. In such cases the damage to or destruction of a boundary marker which is caused by the inhabitants of one party shall be repaired at the expense of that party.

Article 6

1. The boundary ^{strips} firebreaks which are 8 meters wide (4 meters on either side of the boundary line) shall be kept in complete repair and, when necessary, shall be cleared of bushes and scrub which hinder visibility.

^{strips} Cutting of the land and construction of buildings of any kind in the ~~firebreaks~~ is forbidden. Persons guilty of this shall be held responsible.

^{his} 2. Each of the parties shall clear the boundary firebreaks on ~~their~~ own territory. The proper authorities of the contracting parties shall notify each other of any forthcoming work on the boundary ^{strips} firebreaks at least 10 days before the operations begin. Representatives of the proper authorities of the other contracting party has the right to be present during such work.

CHAPTER II

Boundary waterways and rules for their use (maritime traffic, floatage, fishing).

Article 7

1. By boundary waterways in this agreement is meant the Pasvikeli River (Pates-joki) with the two lakes it forms from boundary marker Number 9 and Number 10 to boundary marker Number 104, and the Jukabokli River

(Voronez) with the lakes it forms from boundary marker Number 322 to boundary marker Number 415.

2. The contracting parties shall take the necessary steps to see that the decisions in this agreement are observed in connection with the utilization of the boundary waterways and that the rights and interests of the other contracting party in connection with the boundary waterways are respected.

Article 8

1. In boundary rivers and in the narrow parts of lakes the vessels (ships, boats) of both contracting parties have the right to proceed in the main channel even though the boundary line might not follow it.

2. On lakes, with the exception of the narrow parts of the lakes which are mentioned in Point 1 of this Article, vessels shall have the right to proceed up to the boundary line. The vessels shall not be used in connection with the flottage of timber down the river. The boundary lines in lakes and rivers.

3. The vessels of the contracting parties have the right to put in to the shores of the other contracting party in case of distress (storm, shipwreck, etc.) and the vessels of the other contracting party concerned shall offer the necessary assistance.

Article 9

1. On the border rivers vessels belonging to the contracting parties may only proceed during the light hours of the day. At night they must be moored to their own shore or else lie at anchor in their own waters.

On lakes, vessels may proceed in the dark as well, but they must keep a distance of at least 200 meters from the boundary line. In any case they must carry lights which in clear weather are visible at least

from 500 meters.

2. All vessels plying boundary waterways must fly the flag of their country or have the flag painted on both sides of the hull, and they must be identified with clearly visible numbers in white or black.

3. Vessels do not have the right to anchor in the main navigable channel.

Article 10

1. The right of normal floatage of lumber in the boundary waterways (Pakana River) and the lakes it forms from boundary markers Number 1 to boundary markers Number 217 and boundary markers Number 218 to boundary markers Number 219 belongs to the Government of Norway.

2. The right of normal floatage of lumber in the boundary waterways (Pakana River) and the lakes it forms from boundary markers Number 219 to boundary markers Number 220 belongs to the Government of Norway. This article shall each year be subject to a joint inspection between the proper authorities of the two countries, and not later than 1 April. Should there be a disagreement in the order, Norway will start first in odd numbered years and the USSR later in even numbered years.

Article 11

1. In order to insure normal floatage the proper authorities of the contracting parties in accordance with Articles 10 and 12 of this agreement -- after sending notice at least 5 days before the beginning of floatage operations -- will allow a foreman with the necessary floatage crew to cross the waterway and move on the opposite shore in order to make general preparatory arrangements for floatage and to make possible the free movement of lumber and to clear the shores for floatage. The workers shall only be allowed to remain on the opposite shore during the light hours of the day, and they shall not be allowed to build fires or to cause any material damage to the other party.

2. No duties or other taxes shall be levied on lumber which is floated in the Pasvik River (Patso-joki) and which belongs to one of the contracting parties.

Article 12

1. All lumber which is floated shall be marked. The proper authorities of the contracting parties, according to agreement, shall in good time establish the markings which are to be used and exchange diagrams of these markings.

2. All lumber which is floated shall be stripped of bark, and care must be taken that the bark does not get out into the Pasvik waterway. Lumber which is floated in bums or rafts does not have to be stripped.

Article 13

1. The inhabitants of both contracting parties have the right to fish in the boundary waterways as far as the boundary line. However, in the entire Pasvikelv (Patso-joki) and Jakobselv (Vorisma) Rivers as well as in the lakes formed by them, the following shall be prohibited:

- a. Use of explosives, poisons, and drugs which can be used to kill or injure ^{fish} fish.
- b. Spearing.
- c. Fishing from boats during the dark hours except on those lakes where vessels according to Article 9, ^{Point} Clause 1 have the right to proceed after dark.

2. Through special agreements the contracting parties may draft regulations on the protection and breeding of fish in boundary waterways, as well as on the preservation of fish in more limited sections, on fishing seasons, and on other types of economic problems which have to do with fishing.

Article 14

1. The contracting parties shall take care that the boundary waterways are kept clean and do not become objects of littering and contamination. The parties will also take the necessary steps to prevent damage to the shores of boundary rivers and lakes.

2. Questions connected with the erection and running of all types of installations or constructions on the Pasvikolvi River (Patsokjoki) and the Jakobselv River (Voriselva), and on their tributaries, which can affect the water level and traffic on these rivers, shall be adjusted through special agreements between the contracting parties.

Article 15

The proper authorities of the contracting parties shall as far as possible exchange information on the water level, the traffic, and the ice situation in the boundary waterways in order to prevent danger or damage which might arise as the result of floods or ice-breaking.

CHAPTER III

Hunting, agriculture, and miningArticle 16

1. Each of the contracting parties shall see that the hunting rules which are in effect in their territory are carefully adhered to in the vicinity of the boundary and that during hunts the pursuit of deer and fowl over the boundary does not take place.

2. The proper authorities of both contracting parties, whenever it is suitable, shall attempt to agree on all questions having to do with the protection of wild life (game and fowl) and also on closed seasons in more closely defined sections near the boundary.

Article 17

1. In areas adjacent to the boundary the contracting parties shall

injure the farming and forestry of the other party.

2. Should a forest fire break out in the vicinity of the border, the contracting party on whose territory the fire started shall, to the extent of its ability, make every effort to restrict and extinguish the fire and prevent its spread across the boundary.

3. Should the border of a forest fire spreading across the territory of one of the contracting parties on whose territory the fire started shall be situated in the vicinity of the border, the contracting party on whose territory the fire started shall take the necessary measures to restrict and extinguish the fire at the boundary.

4. In the event of a forest fire in the vicinity of the border, the proper authorities of the contracting party on whose territory the fire started shall take the necessary measures to see that the fire is restricted and extinguished at the boundary and that the fire does not spread across the border into the territory of the other contracting party. The proper authorities of the contracting party on whose territory the fire started must inform the other party's proper authorities of the fire.

Article 18

1. The contracting parties shall not take place in such a manner that damage is done to the other party's territory.

2. To ensure the preservation of the boundary line there must be a belt of 20 meters on each side of it, where activities as named in *Point* 1 of this Article shall as a rule be prohibited and only allowed in certain cases after agreement between the proper authorities of the contracting parties.

3. If in certain cases it should prove inadvisable to adhere strictly to a strip as defined in *Point* 2 of this Article, the proper authorities of the contracting parties shall, by mutual agreement, take the necessary steps to protect the boundary line.

CHAPTER IV

Conflicts and incidents at the boundary

Article 38

The proper authorities of the contracting parties are under the obligation:

A. To take the necessary measures to prevent conflicts and incidents which might arise on the boundary;

B. To investigate and if possible to adjust all conflicts and incidents on the boundary, for example:

1. Shooting across the boundary at people, animals, objects, or the other party's territory;

2. Cases where persons on the territory of one of the parties are killed or wounded as the result of shots fired across the boundary or while passing across the boundary; or are bodily injured, or are exposed to acts of violence;

3. Insulting language or acts against the other party on the boundary;

4. Unlawful crossing of the boundary by public servants or private persons: In such cases the proper authorities of the contracting parties shall make an immediate investigation, and if it is established that the crossing of the boundary was unintentional such persons shall immediately be taken back to the territory of the state from which they came. Neither of the contracting parties has the right to refuse to take back persons after it has been established that they have crossed the boundary unintentionally.

5. Cases where persons are illegally brought to the territory of the other party;

6. Unlawful flights across the boundary by aircraft, and likewise unlawful crossings of the boundary by river vessels, boats and other

means of transportation;

7. Discovery of fishing boats, traps, or other objects which as a result of natural circumstances have chanced to enter the territory of the other party;

8. Moving, damaging, or destroying of boundary markers;

9. Photographing of the border territory of the other party;

10. Theft, destruction or damage to public or private property on the territory of the other party;

11. Cases where reindeer, domestic animals, and poultry stray across the boundary. In such cases the reindeer, domestic animals, and poultry which have crossed the boundary, with reservations regarding compensation for damage, shall as far as possible be returned to the other side where they belong;

12. Cases where fire spreads across the boundary and into the territory of the other party;

13. Conversations and other kinds of intercourse across the boundary between public servants or private persons who are not authorized;

14. Other conflicts and incidents on the boundary.

C. To investigate and, within their area of authority, to settle all kinds of compensation claims which are the result of conflicts or incidents on the boundary and which are made by one of the parties or by persons who find themselves on the territory of the party concerned.

Whenever the proper authorities of the parties adjust conflicts and incidents on the boundary in accordance with ^{Points} ~~Articles~~ 6, 7, 10, and 11 in this Article, they shall at the same time settle questions on the method of procedure for the restitution of property which has come into the territory of the other party.

CHAPTER V

Boundary authorities, their place of residence, area of activity, and rules for crossing the boundary

Article 20

By proper authorities as named in this agreement is meant the boundary commissioners, their deputies and assistants.

Article 21

The boundary commissioners shall be appointed from the Norwegian side by the Royal Norwegian Government, and from the Soviet side by the Government of the USSR.

The boundary commissioners shall cooperate with each other in carrying out all the duties which follow from the stipulations in this agreement.

Article 22

The number of boundary commissioners and their areas of activity shall be established in a protocol to be attached to this agreement.

The name and official place of residence of the boundary commissioners shall be communicated to the other party through diplomatic channels.

Article 23

Each boundary commissioner shall have the right to appoint a deputy and assistants.

The boundary commissioners shall keep each other informed on the names and official residences of deputies and assistants.

The deputies shall enjoy all privileges granted to the boundary commissioners. They shall exercise the authority of the commissioners when these are prevented from appearing.

The extent of the assistants' privileges shall be defined in the authorisations issued to them by the boundary commissioners.

Article 24

Written authorisations worded in the language of both parties shall be issued to persons mentioned in Article 20 of this agreement, thus:

To the Norwegian boundary commissioner -- by the Royal Justice and Police Department.

To the boundary commissioner of the USSR -- by the chief of the border patrol under the Department of the Interior of the Soviet Union.

To the deputies and assistants -- by the boundary commissioner.

Article 25

The boundary commissioners shall take all steps within the scope of their authority to adjust conflicts and incidents on the boundary. Each boundary commissioner shall have the right, at his discretion, to turn any important question over for diplomatic settlement, after having informed the other party's boundary commissioner on the matter.

Particularly serious conflicts and incidents on the border, as for example murder or serious bodily injury, shall always be submitted to diplomatic settlement. However, in all such cases the boundary commissioners shall make the necessary investigation of the conflict or incident and set down the results of the investigation in a meeting protocol.

Conflicts and incidents on the adjustment of which the boundary commissioners cannot agree shall be submitted to diplomatic settlement. The stipulations of this article shall not prevent the problems which are submitted to diplomatic settlement from being returned to the boundary commissioners.

Problems on which the assistants cannot reach a solution shall be

turned over to the boundary commissioners for settlement.

Article 26

Actual settlements of conflicts and incidents on the boundary which are reached jointly by the boundary commissioners shall be final.

However, settlements for damage claims, the sum total of which exceed an amount corresponding to 500 American dollars, shall be approved by the Norwegian Ministry of Foreign Affairs and by the Ministry of Foreign Affairs of the Soviet Union. The computation of the amount due to each party, with reference to the agreement reached on compensation claims, shall be undertaken by the boundary commissioners on 31 March, 30 June, 30 September, and 31 December of each year. The method of procedure for the payment, and eventual alterations in this method of procedure, shall be established through diplomatic channels.

Article 27

As a rule, the boundary commissioners and their assistants shall carry out their joint work by means of conferences and meetings. For each conference between the boundary commissioners a protocol giving a brief account of the course of the meeting and the decisions reached shall be kept.

Once a protocol is signed, the decisions of the boundary commissioners shall be considered binding and final for both parties.

Lesser questions may be settled through correspondence between the boundary commissioners if neither of them desires to have such question handled in a conference.

For each meeting between the assistants a report shall be drafted explicitly stating what was undertaken and possible conclusions and proposals.

Settlements which are reached by the assistants shall only become valid after having been approved by the boundary commissioners.

The protocols and reports on the conferences of the boundary commissioners and the meetings between the assistants shall be drafted in four copies, two in Norwegian and two in Russian.

Article 28

Conferences or meetings between the boundary commissioners shall take place at the request of one of them and at a time which is as close as possible to the time requested. Reply to the request shall be given as soon as possible and in any case no later than 48 hours after receipt of the request. If the proposed time for the conference or meeting is not suitable, another time shall immediately be proposed in the reply.

Whenever one of the boundary commissioners requests a conference or meeting, the boundary commissioner of the other party shall attend in person unless he has a valid excuse (for example sickness, business trip, vacation). In such cases the boundary commissioner's deputy shall attend, and he shall inform the other party's boundary commissioner of this well in advance. By agreement between the boundary commissioners, conferences and meetings may be held between their deputies.

Meetings between the assistants may only take place on assignment by the boundary commissioners.

Conferences or meetings between boundary commissioners or assistants may, aside from these persons, be attended by secretaries and interpreters as well as experts from each side whenever necessary.

Article 29

As a rule, the conferences and meetings dealt with in Article 28

shall take place on the territory of the party whose boundary commissioner has taken the initiative towards the conference or meeting. If advisable, however, the boundary commissioners or assistants may agree to forgo this principle.

The conferences or meetings shall take place under the chairmanship of the boundary commissioner or the assistant of the party on whose territory the discussions take place.

The agenda shall be proposed at the time of the request for a conference or it may be established in advance through negotiations or correspondence.

In extraordinary cases and after mutual agreement questions not on the agenda may be brought up for discussion.

Article 30

Following previous discussions, the boundary commissioners and their assistants may conduct on-the-spot investigations of conflicts and incidents on the boundary in order to clarify the circumstances of the occurrence.

Such investigations shall be under the chairmanship of the party on whose territory they are conducted.

Reports or other documents pertaining to the investigations shall be kept and attached to the meeting protocols. These reports and other documents shall be drafted in accordance with the rules established in Article 27 of this agreement.

A joint on-the-spot investigation shall not be construed to be like a legal inquiry or other transaction which comes under the legal or administrative authorities of each of the parties.

Article 31

The boundary commissioners shall be under obligation to inform

each other as soon as possible of any measures undertaken in connection with resolutions concluded during a conference or meeting.

Article 12

By agreement the boundary commissioners shall establish meeting places on the boundary where the exchange of official notifications is to take place, and likewise where the restitution of persons or property is to be effectuated in accordance with ^{Article} clauses 4, 6, 7, and 10 of Article 19. The restitution of animals shall take place in the district where these had strayed across the boundary.

The boundary commissioners or their assistants shall agree on the time and place for each such restitution.

Official notifications shall be accepted at any time of day or night as well as on religious and other holidays.

The restitution of persons shall be personally undertaken by the boundary commissioners or their assistants. All other official transaction enumerated in this Article may be carried out by officers in the border patrol acting for the boundary commissioners without the latter having to be present.

By mutual agreement the boundary commissioners shall establish forms for receipts which are to be issued upon acceptance of a notification or upon receipt of animals and other property.

The boundary commissioners shall agree on signals to be used in calling the border patrol of the other party.

Article 13

The boundary commissioners, their deputies, assistants, secretaries, interpreters and experts shall be allowed to cross the boundary to perform those official acts which follow from the stipulations of this agreement.

The boundary commissioners, their deputies, and their assistants will cross the boundary by virtue of the written authorization referred to in Article 24 of this agreement. The authorization shall include the bearer's photograph and signature, and shall be visaed by the boundary commissioner of the other party (forms for authorization, see attachments 1 and 2).

Secretaries, interpreters, and experts will cross the boundary by virtue of a certificate issued by the boundary commissioner of one of the parties. The certificate shall include the bearer's photograph and signature, and shall be visaed by the boundary commissioner of the other party (forms for certificates, see attachment 3).

The above-named visas shall be issued for several boundary crossings and shall be valid for periods of up to six months.

Aside from the above-named persons, the boundary may be crossed by foremen and the floatage crews referred to in Article 11 of the agreement. The foreman shall be ^{provided} endowed with the same type of certificate as is provided for secretaries, interpreters and experts, but only for the duration of the floatage operations. No special certificate shall be issued to the workers. Their names shall be listed on a roster which must be signed by the boundary commissioner of one party and visaed by the boundary commissioner of the other party. The foreman must always carry the visaed roster of workers and must show it on demand to the border authorities of the other party.

In addition, persons whose presence is necessary in order to clarify one problem or another may cross the boundary by virtue of a certificate for one boundary crossing each way, valid 24 hours from the moment the boundary is crossed. The certificate shall be issued by the boundary commissioner of one party and visaed by the boundary commissioner of the other party (forms for certificate, see attachment 4).

Article 34

The persons named in the first paragraph of Article 33 of this agreement may cross the boundary only at those points which are established in Article 32, unless the boundary commissioners or their assistants have reached an agreement on another place for such crossings.

Notification as to the date and exact time for such a boundary crossing shall be given well in advance, and no later than 24 hours beforehand, to the other party's nearest border patrol unit, which is under obligation to send an escort to the meeting place.

The boundary commissioners and other persons named in the first paragraph of Article 33 of this agreement shall have the right to wear uniforms and carry personal weapons.

Article 35

The boundary commissioners and other persons named in the first paragraph of Article 33 of this agreement shall be granted personal immunity as well as immunity for the official papers they carry.

The above named persons shall have the right to bring the necessary working equipment and means of transportation duty free and free of charge into the other party's territory, on condition that these objects are brought back again, and also tobacco and the necessary stores.

The persons named in the fifth and sixth paragraphs of this agreement may not be detained during their stay on the other party's territory.

Article 36

Each of the contracting parties shall cover all expense connected with the fulfillment of their duties resulting from this

Article 37

Each of the parties shall lend the necessary assistance in procuring transportation, lodging, and access to contact with their own authorities to persons named in the first and sixth paragraph of Article 33, when these persons find themselves on the territory of the other party in connection with the fulfillment of duties according to this agreement.

FINAL PROVISIONS

Article 38

This agreement shall be valid for five years. If neither of the contracting parties denounces the agreement six months before the validity period elapses, or gives notice that it wishes to work out more closely, defined conditions, the agreement shall automatically become valid for each successive five-year period.

Article 39

This agreement shall be ratified. The exchange of ratification documents shall take place in Moscow within the shortest possible time. The agreement shall go into effect with the exchange of ratification documents.

Article 40

This agreement is drawn up in two copies, both in Norwegian and Russian, and both texts shall have the same validity.

To confirm this, the plenipotentiaries of the contracting parties have signed this agreement and provided it with their seals.

Signed in Oslo, 29 December 1949

By the Authority of
the Norwegian Government:
(signed) H. Gabrielsen

By the Authority of the
Government of the Soviet Union:
(signed) I. V. Mayevskiy

PROTOCOL

for the agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary and on the method of procedure in the adjustment of conflicts and incidents on the boundary.

With regard to Article 22 in the agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary and on the method of procedure in the adjustment of conflicts and incidents on the boundary -- negotiated in Oslo on 29 December 1949 -- the undersigned plenipotentiaries of the contracting parties, agree that boundary commissioners shall be construed to mean the following:

A. On the Norwegian side:

The boundary commissioner for the Norwegian-Soviet boundary with a district of jurisdiction from the boundary marker which is erected at the point where the boundaries of Norway, the USSR, and Finland meet on Krokfjell Mountain (Muotkavara) to boundary marker 415 at the mouth of the Jakobselv River (Voriena).

B. On the Soviet side:

The boundary commissioner for the Norwegian-Soviet boundary with a district of jurisdiction from the boundary marker which is erected at the point where the boundaries of Nor-

Signed in Oslo, 29 December 1949

By the Authority of
the Norwegian Government:
(signed) H. Gabrielsen

By the Authority of the
Government of the Soviet Union:
(signed) I. V. Mayevskiy

PROTOCOL

for the agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary and on the method of procedure in the adjustment of conflicts and incidents on the boundary.

With regard to Article 22 in the agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary and on the method of procedure in the adjustment of conflicts and incidents on the boundary -- negotiated in Oslo on 29 December 1949 -- the undersigned plenipotentiaries of the contracting parties, agree that boundary commissioners shall be construed to mean the following:

A. On the Norwegian side:

The boundary commissioner for the Norwegian-Soviet boundary with a district of jurisdiction from the boundary marker which is erected at the point where the boundaries of Norway, the USSR, and Finland meet on Krokfjell Mountain (Muotkavara) to boundary marker 415 at the mouth of the Jakobselv River (Veriama).

B. On the Soviet side:

The boundary commissioner for the Norwegian-Soviet boundary with a district of jurisdiction from the boundary marker which is erected at the point where the boundaries of Nor-

way, the USSR, and Finland meet on Krokfjell Mountain (Muotkavara) to boundary marker 415 at the mouth of the Jakobselv River (Voriama).

This protocol, which is an integral part of this agreement, is made out in two copies, both in Norwegian and Russian, and both texts are equally valid.

Signed in Oslo on 29 December 1949

By authority of the
Norwegian Government:
(signed) H. Gabrielsen

By authority of the
Government of the USSR:
(signed) I. V. Mayevskiy

CONCLUDING PROTOCOL

In conclusion to an agreement between the Royal Norwegian Government and the Government of the USSR regarding various circumstances on the Norwegian-Soviet boundary, and on the method of procedure in the adjustment of conflicts and incidents on the boundary, the undersigned plenipotentiaries agree on the following provisions which constitute an integral part of the agreement:

Re Article 1 of the Agreement

Boundary marking documents shall be construed to mean the following:

A. A description protocol for the ^{international} state boundary between Norway and the USSR, from the tri-state boundary cairn which is erected where the boundaries of Norway, the USSR, and Finland meet on Krokfjell Mountain (Muotkavara) to boundary marker No. 415 at the mouth of the Jakobselv River (Voriama), with the respective appendices attached to that protocol;

B. An album with maps and geodetic diagrams of the ^{international} state boundary between Norway and the Soviet Union;

C. Protocols of boundary markers with diagrams -- sketches -- and photographs of the boundary markers on the reverse.

Re Article 21 of the Agreement

The first meeting between the boundary commissioners concerning the organization of their work shall take place not later than 14 days after this agreement goes into effect.

Re Article 23 of the Agreement

Notification on the appointment of the boundary commissioners' deputies and assistants and on their official places of residence and districts of jurisdiction shall be given by the boundary commissioners at their first meeting after this agreement goes into effect.

The deputies' and assistants' official places of residence and the number of assistants as well as the limits of their areas of operations may be changed by the boundary commissioner concerned, during the time this agreement is in effect.

Re Article 32 of the Agreement

Meeting places on the boundary shall be established by the boundary commissioners at their first meeting after this agreement has gone into effect.

The number and location of these meeting places may be changed by the boundary commissioners upon mutual agreement.

This protocol is drawn up in two copies, both in Norwegian and Russian, and both texts shall have equal validity.

For the confirmation hereof the plenipotentiaries of the contracting parties have signed this concluding protocol.

Oslø, 29 December 1949

By authority of the
Norwegian Government:
(signed) H. Gabrielsen

By authority of the
Government of the USSR:
(signed) I. V. Mayevskiy

STORTING PROPOSAL NUMBER 119

(1948)

PROCUREMENT OF THE CONSENT OF THE STORTING FOR NORWAY'S APPROVAL
OF THE DOCUMENTS OF THE NORWEGIAN-SOVIET BOUNDARY SURVEY OF 1947

Proposal from the Ministry of Foreign Affairs on 17 September, 1948,
approved by Government Resolution on the same day

(Presented by Foreign Minister Halvard M. Lange)

I.

The Ministry of Foreign Affairs hereby takes the liberty to make a proposal concerning the question of Norwegian approval of the boundary documents that were prepared during the Norwegian - Soviet boundary survey of 1947.

The starting point at the southern extremity of the Norwegian-Soviet common boundary is the tri-state boundary cairn on Krokfjell Mountain (Muotkavaara) in Sør-Varanger District, From Krokfjell Mt., the boundary runs through a cleared strip in a south-easterly direction, through rugged and partially-marshy wooded terrain, crosses the Pasvikely River, and continues to the cairn on the Gelsomio headland on the right side of the river. From the Gelsomio headland, the boundary follows the Pasvik waterway in a northeasterly direction to the Skoltefoss Falls, along the thalweg of the river and essentially through the center of the lakes formed by the river. At the Skoltefoss Falls, immediately south of the main fall, the boundary turns sharply westward, crosses the left river bank and continues, first in a westerly, then in a northwesterly and east-northeasterly direction around the Boris Gleb region until it crosses the right bank of

the Pasvikelv River. Thence the boundary continues overland in an east-northeasterly, southeasterly, and east-southeasterly direction through very rugged terrain over bare mountains and wooded valleys to the headwaters of the Jakobselv River. It then follows the Jakobselv River to its outlet in the Varanger Fjord, following the thalweg of the river, and essentially along the center of the lakes formed by the river. The main direction of the boundary in the Jakobselv River (the river flows in a series of meanders) is at first easterly, turning toward northeast, after which it runs north and north-northwest. From the outlet of the Jakobselv River the boundary runs north and north-northwest to a buoy, the exact position of which is indicated by alignment markers on land, and which denotes the northern terminal point of the boundary between Norway and the USSR. The length of the boundary from Krokfjell Mountain to the terminal point in the outlet of the Jakobselv River is approximately 196 kilometers.

II.

The historical development concerning the stretch of borderland from Krokfjell Mountain to the outlet of the Jakobselv River is briefly the following (The Ministry of Foreign Affairs has had an exhaustive statement prepared which includes a presentation of the history of the Finnmark-Petsjenga boundary, the Norwegian-Soviet negotiations in Moscow in 1946 and in Oslo in 1947, the 1947 boundary survey, and the negotiations in Moscow that same year. The report is printed as Appendix 1 of the present proposal).

In the Agreement of 2-14 May 1826 (printed as Appendix 2 of the present proposal) between Norway/Sweden and Russia "concerning the

fixing of the boundary between Norway and Russia" it was decided that the districts of Nelden, Fasvik, and Peisen (Petsjenga) would be divided between Norway and Russia. Until 1926, these districts had been a joint domain of the countries -- but "to promote goodwill in all intercourse among their subjects" and "to prevent friction which heretofore may have arisen as a consequence of the lack of ^asatisfactory settlement of the boundary between Norway and Russia in the Lapp districts, which are known as Fellesdistrikter [common districts] a dividing line was drawn between the two countries according to a boundary specification which was more closely defined in Article 2 of the Agreement.

In accordance with the stipulations of the Agreement, a boundary survey was undertaken in 1926, in which representatives of the governments of both countries participated. There is a protocol from this boundary survey dated 16-28 August 1926 (see Appendix 3 of the present proposal), which gives a relatively detailed description of the boundary's course over the terrain.

After the establishment of the 1926 Agreement, there were additional boundary surveys and adjustments on the Norwegian-Russian boundary in the years 1946, 1971 and 1996. In 1896, furthermore, new maps of the boundary were drafted. (See Appendix 4 of the present proposal).

At the peace negotiations of 14 October 1920 in Dorpat (Tartu) between Finland and the Soviet Union, the Petsamo region (Petsjenga) was transferred to Finland. In order to bring the treaty terms concerning the common boundary between Norway and Finland into formal order, an agreement was concluded between the two countries regarding the international boundary between the Finnmark fylke [Province] and the Petsamo district. This agreement, which was signed on 28 April 1924 -- following previous negotiations between representatives from the

governments of the two countries -- in Article 1 stipulates the following:

"The boundary between Norway and Finland from the middle cairn on Mutkavaara [sic] to cairn 362 by the upper course of the Jakobselv River (Vuoremajoki) thus remains as it was indicated in the Norwegian-Russian boundary surveys and documents and in agreement with the maps established in the course of the 1996 border revision..."

Article 2 stipulates:

"From cairn 362 the boundary follows the course of the Jakobselv River (Vuoremajoki) to its outlet, in such a way that it always follows the thalweg of the river and the middle of the lakes formed by the river...."

Thus no change in the boundary's course was undertaken in this agreement between Norway and Finland.

During the recently terminated war, in the armistice agreements of 21 September 1944 between the Soviet Union, Great Britain and Northern Ireland on the one hand and Finland on the other, it was decided in Article 7 that the Petsjenga region should be returned to the Soviet Union.

Thus Norway again acquired a common border with the Soviet Union, from Krokfjell Mountain to the outlet of the Jakobselv River in the Varanger Fjord.

III.

As far as the course of the boundary line itself is concerned, of course, no change occurred as a result of the return of the Petsjenga region to the Soviet Union. However, it was necessary to bring about a formal treaty between Norway and its new neighbor concerning the course of the boundary. After a few preliminary discussions

between the governments of the two countries in 1945, the Soviet Government, in a note dated 2 June 1946, proposed to the Norwegian embassy in Moscow that a Norwegian delegation be sent to Moscow to discuss the practical arrangements for a new survey of the boundary. In view of this, a delegation was appointed by Royal Resolution on 19 July 1946 (as amended by Royal Resolution on 15 November 1946), the mandate of which was "...through negotiations with the Soviet Government to bring the treaty terms concerning the international boundary between Norway and the Soviet Union into formal order, and in this connection to participate in a joint Norwegian-USSR survey of the boundary."

The following were appointed members of this delegation:

The Provincial Governor of Finnmark, Hans Gabrielsen, Chairman;

The Director of the Norwegian Geographic Survey, Kristian

Gleditsch;

Floatage Director, Johannes Johannesen;

Bureau Chief in the Ministry of Foreign Affairs, Eigil Nygaard;

Lieutenant Colonel Harald Wrede Holm; and

Secretary in the Ministry of Foreign Affairs, Knut Aars, the delegation secretary.

The negotiations with a corresponding Soviet Government delegation took place during the period 1-16 August 1946 in Moscow.

The two delegations installed themselves as "The Joint Soviet-Norwegian Commission for the marking of the international boundary between the Soviet Union and Norway," and in a Regulation for the Joint Commission, agreed to employ the documents from the 1826 Norwegian-Russian boundary survey as a basis for the actual fixing of the boundary. The documents from the more recent surveys were to serve as interpretation material, including the Norwegian-Russian border maps drafted in 1896.

In this connection it was definitely decided that the boundary line would be fixed according to the exact same principles as those that had been effective since the partition of the jointly-owned districts was effectuated in 1926.

The actual technical execution of the boundary survey was the subject of thorough discussions between the two delegations. From the Soviet side, a different method for marking the boundary was suggested from the one that Norway had previously been using; namely, marking by means of wooden posts in pairs, one pole on either side of the boundary line and 2 meters from it (thus a distance of 4 meters between a pair of posts), and with such a distance between the pairs of posts that they were easily visible from one pair to the next. In exceptional cases, stone cairns could be used.

From the technical point of view this marking method offered obvious advantages; the boundary line would be particularly clearly marked in the terrain, and the risk of inadvertent boundary transgressions reduced to a corresponding degree. On the other hand, the method was more complicated and costly than the previous marking with stone cairns. However, considering the important economic and other interests attached to the stretch of boundary in question, the Norwegian delegation found that the advantages in carrying out as clear and unambiguous a marking as possible relatively outweighed the cost it would entail. Therefore the delegation accepted the Soviet proposal.

The Joint Commission furthermore agreed to undertake a new charting of the border districts to a scale of 1:25,000 over a strip that was 1 kilometer wide, 500 meters on each side of the boundary line, and to have a detailed description protocol of the course of the boundary prepared. For each boundary marker a separate protocol was to be set up, containing a description of the marker's location in the

terrain, and a photograph and a schematic sketch on the back page.

The Joint Commission decided to try to have the boundary survey completed within the period 1 July - 1 September 1947. To supervise the field work, 2 joint Norwegian-Soviet Subcommissions were to be named, each consisting of 1 chief, 2 members, and 1 secretary from each country. The operational area for the First Joint Subcommission was fixed as the sector from Krokfjell Mountain to Trongsaund in the Pasvikelv River, the operational area for the Second Mixed Subcommission from Trongsaund to the outlet of the Jakobselv River. The line of demarcation between the areas was later moved 3.7 kilometers farther north, to Holmfoss. In the First Subcommission, the Soviet members, with the necessary technical personnel, were to have the responsibility for the execution of the work, while the task of the Norwegian members was of a checking nature; in the area of the Second Subcommission, the working distribution was the reverse.

The Joint Commission was to be present during the boundary survey, to supervise the work in both areas by means of spot checks, and by means of negotiations to solve any disputes that might arise.

IV.

After the return of the Boundary Delegation, the results of the Moscow negotiations were submitted to the Government, and the Regulation of the Mixed Commission, in which the operating procedure for the Norwegian-Soviet boundary project was drawn up, was approved by government resolution on 20 December 1946.

In March 1947 the Joint Commission held a new meeting, in Oslo, to discuss and decide on a series of questions of a practical and technical nature concerning the field work. During this meeting certain supplementary regulations were adopted concerning the methods

of procedure in determining the boundary line when it followed water-courses. Concerning these negotiations, reference is made to Appendix 1, Section 9, of the present proposal.

In May 1947 the Ministry of Foreign Affairs forwarded a proposal to the Storting for the appropriation of the necessary means to carry out the boundary survey and of the subsequent office work that would take place in Moscow. The proposal was printed as Storting Proposal Number 1, Supplement Number 26 (1947) and was passed by unanimous decision by the Storting on 3 July 1947.

The Norwegian-Soviet boundary survey took place between 1 June and 4 September 1947. A total of 415 boundary markers were herewith set up on the tract of land from Krokfjell Mountain to the mouth of the Jakobselv River, of which there were 397 pairs of posts, 25 cairns, 2 pairs of alignment markers and one buoy. One pair of alignment markers and the buoy have the same number, No. 415. The markers are otherwise numbered in succession from 1 to 415. The tri-state marker on Krokfjell Mountain is unnumbered. The boundary posts are painted yellow in the Norwegian side and have 10 centimeter high tops, while those on the Soviet side are painted with wide alternating red and green stripes. On the sides of the posts which are turned toward the boundary line, the coat of arms of the country is attached.

During the boundary survey, moreover, a topographical map in the scale of 1:25,000 was prepared. A detailed description protocol was prepared on the course of the boundary, and a separate protocol was prepared for each individual boundary marker. Special tables were prepared as attachments to the description protocol, containing, among other things, the geodetic data for the boundary markers.

The actual placement of the boundary in the terrain was, in

certain cases, subject to discussion in the Joint Commission.

In the Regulation for the Joint Commission, Article II, the Commission was given permission in certain cases to undertake minor regulation of the boundary when it seemed appropriate "with regard to local conditions." In connection with this, the Soviet side made a proposal on the regulation of the boundary at Grensefoss Falls (Gelsenic, -- see section I in this proposal), where the boundary line goes in on the right hand side of the Pasvikely River in such a manner that two small areas of approximately 32,500 square meters combined, between the previous boundary cairns No. 354 and 355, are Norwegian territory, and where Norway, as a result, owns both banks. The Soviet side further proposed that a Norwegian area of approximately 103,000 square meters on the Norwegian side of the Pasvikely River south of the main falls in the Skoltefoss Falls, be exchanged with a Soviet area of approximately 113,000 square meters on the north side of the Boris-Gleb polygon.

Both these proposals were rejected by the Norwegian side on the ground that at Grensefoss Falls as well as at Skoltefoss Falls a problem of a technical nature with regard to damming would arise which would naturally have to be solved in connection with possible Norwegian-Soviet negotiations on the distribution and damming of the combined water power in the Pasvik waterway.

According to the thalweg measurements in the Pasvikely River, the Soviet side posed additional demands for a transfer from Norwegian to Soviet sovereignty of Kisteholmen Island (approximately 144,500 square meters), Brennholmen Island, and an unnamed island in the Vaggatemstryk Rapids (combined area of approximately 40,000 square meters). The Norwegian Delegation demanded the transfer to Norwegian sovereignty of Skolteholmen Island in the Vaggatemvatnet Lake (about 500,000 square meters and the island of Nivasaari (approximately 212,000

square meters).

The Joint Commission did not reach an agreement on a possible transfer of these areas during the meetings which took place. Therefore, as far as these areas were concerned, the commission resolved to return to the old boundary line as it was placed on the Norwegian-Russian boundary map of 1896. (A new decision was later reached on the boundary line at Kisteholmen Island, Brennholmen Island, and the unnamed island in the Vaggatemstryk Rapids. See below).

In the marking of the boundary in the mouth of the Jakobselv River, disagreement arose as to the course of the boundary line. The Soviet side maintained that this boundary should be placed exactly as indicated on the maps from 1896 (especially a so-called cairn map in the scale of 1:8,400, drafted in 1896 on the then existing national cairn No. 363 and vicinity). Since the thalweg of the river mouth had altered its course since 1896, the placement of a boundary line to correspond with the 1896 map would now mean that the Norwegian inhabitants in the Jakobselv River valley would not be able to use the harbor inside the river mouth; also, at low water level they would be cut off from free access to the river mouth from the sea.

The Norwegian Delegation held that the thalweg, and [not?] the maps from 1896, should be the decisive factor in the placement of the boundary line. The Soviet Delegation, on the other hand, again took up the question of regulating the boundary at Grensefoss Falls, and maintained that if the thalweg principle were to be followed consistently, for example, in the mouth of the Jakobselv River, the boundary line would also have to be placed according to the thalweg through Grensefoss Falls.

From the Norwegian viewpoint it appeared vitally important to insure the inhabitants on the Jakobselv River the free use of the harbor inside the river mouth, and free entrance to the river mouth from the sea.

After thorough discussions by the Joint Commission, it was decided to place the boundary line in the mouth of the Jakobselv River according to the thalweg, as had been maintained by the Norwegian side. At the same time, the Soviet side abandoned its demands for regulation of the boundary's course at Grensefoss Falls. In return, the Norwegian Delegation had to consent to the transfer of the above-named small islands in the Pasvik waterway, Kisteholmen, Brønnholmen and the unnamed island in the Vaggatemstryk Rapids.

In the opinion of the Ministry of Foreign Affairs, this solution was the best possible compromise under the circumstances. Further particulars are shown in the detailed statement in Appendix No. 1, Section 10, of the present proposal.

The boundary between the sea territories of the two countries was the subject for certain preliminary discussions between the two delegations. When it was seen that the viewpoints of the two sides differed, the Joint Commission decided to allow this question to remain open to possible future diplomatic negotiations between the two governments.

The boundary survey was formally concluded at the meeting of the Joint Commission on 4 September 1947. Those documents (maps, protocols, etc.), which were submitted by the Subcommissions as the result of the summer's work, were approved. It was assumed that the documents would be carefully examined and coordinated with a view to possible editorial corrections during the subsequent office work of the Joint Commission, prior to reproduction.

On 27 September 1947 the Joint Commission began its final review of the documents from the boundary survey. From the Norwegian side, in addition to the Boundary Delegation, 5 of the technical experts who had participated in the fieldwork took part.

The Ministry of Foreign Affairs refers the reader to Appendix No. 1,

Section 11, of the present proposal, for these negotiations.

Not until 10 December 1947 were these original documents completely printed and bound, and the signing took place on the same day.

The signed original documents from the boundary survey of 1947 are as follows:

1. Description protocol on the course of the international boundary between Norway and the Soviet Union (printed as Attachment No. 6 to the present proposal). Two tables containing technical data are contained in the protocol.
2. Album containing a diagram on the placement of the map sheets, maps and geodetic diagrams of the national boundary, as well as sketches of the boundary markers and trigonometric markers.
3. Protocols on the boundary markers set up, in two volumes, one for each Subcommission's area of operations.
4. The Joint Commission's official meeting protocols with attachments (printed as Attachment No. 5 to the present proposal).

The documents named under points 1, 3, and 4 are drawn up in four original copies, 2 in Norwegian and 2 in Russian, so that each of the parties has one original copy each of the documents in each language. Both languages are equally valid. Each party has one signed original copy of the documents named under point 2.

There is attached to the actual boundary documents a "Concluding Protocol" which gives a short resumé of the accomplished work and which states that "all work connected with the marking of the international boundary between Norway and the Soviet Union is carried out in full mutual understanding, and that agreement has been reached on all questions regarding the marking of the boundary." The protocol further provides that all of the boundary documents will go into effect immediately after they have been approved by the governments of both

countries. The approval shall be reported by an exchange of notes.

The documents which are hereby submitted to the Storting for approval have come about after very careful work projected over a long period of time. They represent the result of the negotiations of the Joint Commission and its technical experts during the period from August 1946 until December 1947; and they must therefore be accepted as being as precise and correct as is technically possible.

The Ministry of Foreign Affairs deems it desirable that the conditions of the treaty concerning the Norwegian-Soviet boundary be brought to formal order, and proposes that the documents submitted be approved, and that the approval be subsequently ratified by an exchange of notes with the Soviet Government.

The Ministry of Foreign Affairs advises:

That Your Majesty approve and sign a draft of a proposal laid before the Storting on the procurement of the consent for Norway to approve the documents from the Norwegian-Soviet boundary survey of 1947.

We HAAKON, King of Norway,

hereby proclaim:

The Storting is invited to resolve that the documents from the Norwegian-Soviet boundary survey of 1947 be approved by the Norwegian side, and that the approval be confirmed by an exchange of notes between the Governments of Norway and the Soviet Union.

Done at Oslo castle, 17 September 1948

Under our hand and the seal of the realm

HAAKON
(L.S.)

Einar Gerhardsen

Leif Ostern

APPENDICES

1. The Norwegian boundary in Finnmark from Krokfjell Mountain (Muotkavaara) to the Arctic Ocean.
2. The Convention of 2-14 May 1926 concerning the establishment of the boundary between Norway and Russia.
3. Protocol from 16-24 August 1926 regarding the map of the boundary between Norway and Russia.
4. Protocol of 7-19 September 1926 on boundary inspection and renewal of boundary markers on the border between Norway and Russia.
5. Protocols on the meetings of the Joint Soviet-Norwegian Commission for marking the international boundary between the Soviet Union and Norway.
6. Description protocol from 13 December 1947 on the course of the international boundary between Norway and the Soviet Union, marked in 1947.
7. Index of the layout of the map series of the international boundary between Norway and the Soviet Union at the boundary marking of 1947.
8. a - c. Maps No. 1, 11, and 13 on the international boundary between Norway and the Soviet Union.
9. a - c. Maps No. 1, 11, and 13 of the geodetic net for the international boundary between Norway and the Soviet Union.
10. a - c. Boundary marker protocols No. 191, 250, and 415.
11. a and b. Diagram of boundary markers and buoys.

APPENDIX 1

The Norwegian Boundary in Finnmark

Krokfjell Mountain (Muotkavaara) to the Arctic Ocean

1. The Boundary Conditions until 1914

During the preparations for the boundary negotiations between Norway and Finland after the first world war, Professor Oscar Albert Johnsen worked out, in behalf of the Ministry of Foreign Affairs, an estimable presentation of "The Political History of Finnmark" (published in Kristiania in 1923 in the Videnskapselskapets Skrifter series II. Hist.-Filos. Klasse 1922. No. 3, 353 pages). For a detailed study of the historical basis for the Norwegian-Russian boundary, refer to this treatise. The following brief summary is based upon the most important points of Professor Johnsen's contribution.

Professor Johnsen shows in his introduction that there is no doubt as to whether the Norwegian boundary in the north during the eleventh century -- possibly as far back as Olav Haraldson's time -- extended as far as the White Sea. The sagas call the northeastern extremity "Vaegestafr" (Road Staff), which lay on the Kola Peninsula (it was probably the tongue of land Svyatoy Nos, Helgenes, at the entrance to the White Sea). The later name of this area is also reminiscent of its historical connection with Norway. The old Russian name for the Kola Peninsula, "Murmanskoye Zemlya", and for the sea off it, "Murmanskoye More", actually means "Nordmannslandet" [The Norseman's Country] and "Nordmannshavet" [The Norseman's Sea]. The boundary at this time was only a coast line.

In any case, North-Finnmark must have had a permanent population of Norwegian colonists around the year 1300. Probably this northernmost part of the country was in the beginning essentially a tributary country, but especially from the time of Haakon Haakonson the power of

the Norwegian state and the Norwegian church bound Finnmark steadily closer to Norway through settlement and legislation, erection of churches and spread of Christianity, and even through defence (the Vardøhus fortification was mentioned as early as 1307). This incorporation of Finnmark into the Norwegian State stopped, however, at the Varanger Fjord, and knowledge of the times does not seem to indicate that Norsemen had settled down as permanent residents on the coast of the Kola Peninsula. The first known boundary agreement between Norway and its neighboring country to the east is a peace treaty of 1326 with the republic of Novgorod, where it was determined that "As far as the land and water of Norway's king extends, Norwegians shall have freedom of movement, residence, and the right of ownership to land and water according to the land's old survey, limits, and partition . . . But the partitioning itself we leave to God and Norway's king. He will divide it according to his conscience." By this treaty Novgorod, as representative for the then existing Russia, recognized Finnmark as Norwegian land. Norway's old territorial boundary with Russia was at that time cast into the shadow of the tax boundaries, and from the records of the boundary survey, which was made with reference to the treaty of 1326, it appears that at that time no real land boundary between Norway and Russia was drawn, only tax boundaries. These covered large districts where both Norwegians and Russians would have the right in the future to demand taxes from the Lapps. (After Novgorod's fall in 1478, its rights to taxation were given over to the Grand Duke of Moscow.

By the boundary adjustment of 1326, it can be said that the arrangement with the large fellesdistrikter (jointly-owned districts) had received formal recognition.

Such a situation without established land boundaries and with extensive jointly-owned districts, could naturally not avoid leading to disputes and friction between neighbors; but it is interesting to note that this never led to political disputes between the two countries. On the contrary, there existed through the centuries between Denmark/Norway and Russia a traditional friendship which expressed itself in a series of alliance treaties.

In the 1500's, however, Russian colonization of a religious type started on the eastern part of the jointly-owned districts. Through the hermit Trifon, the cloister, later known as the Pechenga Cloister, was founded in the Years after 1524. In 1556 the tsar (Ivan the Terrible) gave this cloister large grants in the jointly-owned districts, and the cloister had everyone build churches in Peisen, Boris Gleb and Neiden, as well as develop an extensive agricultural and economic program which naturally enough drew further Russian colonization. The question of whether the Russian territory immediately across from Norway could be considered to have the right to conduct colonization of this type in the jointly-owned districts also brought up the question of the legal boundaries between Norway and Russia. In the 1570's and 1580's, through special emissaries to Moscow, a number of communications on the matter were made to the tsar without, however, anything positive being accomplished.

In addition, the tsar began in 1582 to claim the country by the Murmansk Sea as his patrimony, and established a separate functionary (voivod) in Kola to attend to Russia's interests in the border districts. In letters from 1585 to 1586 to King Frederik II, the tsar designated all of Lappland with Kola, Pechenga (Peisen), Neiden, and Pasvik as "his eternal patrimony." It went on, "if someone should look up the old boundaries, it would show that also the city of Vargav (i.e., Vardø) is erected on our patrimony, Lappland." At the same time, however, the tsar proposed in 1585 that commissioners from both

countries should be sent to the border districts "and on the basis of the old boundaries, to set up a new boundary, dig new pits, and cut new boundary stones so that in the future there would be no disorder between Vergav and our districts."

Such a boundary survey was, however, never conducted, since King Frederik II, in answer to the broad claims of the tsar, renewed in 1586 the old Norwegian claims for all of the Kola Peninsula and the Lapp districts south of Varanger Fjord. This active Finnmark policy was also continued very energetically by King Kristian IV. In 1599 he took a trip along the whole coast of Finnmark to east of the Rybachiy Poluostrov Peninsula, and later in the Knaerød Peace Treaty in 1613 he obtained a distinct disavowal by Sweden of all Swedish claims in Finnmark.

Kristian IV, during his entire reign, asserted to Russia the demand for Norway's right to the Kola Peninsula, not only in theory but also as an actual political claim during his many diplomatic negotiations with Russia about the boundary. The tsar, for his part, insisted with the greatest determination that "Lapland is from ancient times our eternal patrimony." An offer from Kristian IV in 1601 of 50,000 daler in exchange for Russian recognition of Norway's exclusive right to the jointly-owned districts was also categorically rejected. ("The tsar would not give up Lapland for 5 times 100,000; for even if the tsar had enough lands, he would sell none of them.") In 1603, however, Tsar Boris Godunov made an offer of a boundary adjustment on the west side of the Pisenelv River, 5 värsts (about 5.3 kilometers) from Pechenga Cloister, so that, among other things, the Pasvikelv River and Boris Gleb in its entirety would be on the Norwegian side of the boundary. Kristian IV could not consider this offer.

The situation in the remainder of the 1600's and 1700's was

such that the Russian Lapp bailiff collected taxes and exercised jurisdiction in all the so-called "northern mountain cities," as well as in *Sør-Varanger* in *Pelzen*, *Pasvik*, and *Neiden* without the Norwegians attempting to stop him. But at the same time the Commandant at *Vardøhus* also collected Norwegian taxes from *Pelzen*, *Pasvik*, and *Neiden* without protest from the Russians. In addition, the Norwegian population on *Varanger Peninsula* had from olden times asserted and consistently utilized the right to lumbering, fishing, and hunting as well as to down and egg gathering in these jointly-owned districts. ("When the Norwegians meet the Russo-Finns in their own fjords and tell them that they have come to cut some wood or timber, the Russo-Finns answer: Cut in the name of God." Major Peter Schnitler, ca. 1745.) On the other hand, no Norwegian taxes were collected from the Lapps east of *Pelzen* later than the winter of 1611-12.

It cannot be denied that from the 1550's on, Russian influence gained among the Lapp population in the jointly-owned districts as a natural result of the Russian administration, jurisdiction, and intermarriage, together with the Russian missionary activity and the erection by the *Pechenga* monks of Russian churches and schools in the jointly-owned districts. On the basis of detailed investigation of commerce within the jointly-owned districts from this time to the end of the 1700's, Professor Johnsen arrives at the conclusion that, for the most part, the *Pelzen* Lapps were commercially tied to Russia, while the *Pasvik* and *Neiden* Lapps and the Norwegian *Varanger* Lapps were bound to Norway through commerce.

After the death of *Kristian IV* in 1648, Norwegian claims to the *Kola Peninsula* were dropped from practical politics (the claim was formally asserted until the Agreement of 1862. The last time Norway received taxes from this district was the winter of 1611-12.

But every winter from then on until 1785, and thereafter every third winter up to and including 1813, the Norwegian mountain bailiff traveled with express instructions from the king to "Malmis" (i.e. Kola) to renew the Norwegian tax claims to the boyar. This so-called "Malmis Trip" was discontinued in 1816 as a part of the boundary negotiations into which Carl Johan entered with Russia, in behalf of Norway) and diplomatic discussions of the boundary question between the two countries were not taken up again until the close of the 1770's. This happened after the local Norwegian authorities had insisted time and again to the government in Copenhagen on the necessity of a boundary regulation which would insure for Norway all three jointly-owned districts if possible, or in any case Neiden and Pasvik.

In 1789 the Danish/Norwegian government set forth an official proposal to the government in St. Petersburg regarding a boundary treaty. Both sides were to appoint commissioners to establish once and for all the boundary between Norway and Russia, thereby to prevent all disputes in the future and to facilitate the realization of the king's plans for the development of Finnmark's commerce and shipping to the advantage of both nations (i.e., Norway and Denmark). It was added that the king would not extend his claim to the then-Russian, previously Norwegian, Lappland as far as his ancestors had done, "even though these claims were just as valid now as in previous centuries," but would limit his desires and pretensions to the jointly-owned districts of Neiden, Pasvik, and Pelson. If the tsar turned these districts over completely to Norway, the king would in return give up all further titles and pretensions.

The Russian Government immediately agreed that it would be advantageous to draw a definitive boundary between the two countries, but at the same time requested that further discussions of the matter be postponed because Russia was at that time at war with Sweden and

Turkey. The government in Copenhagen brought the matter up again several times -- in 1793, in 1797, and in 1809 -- but at no time were any positive results reached.

2. Boundary Negotiations from 1814-1825

For longer than it would appear from the above, there was no success in bringing up the boundary matter so long as the union between Norway and Denmark existed, but shortly after the new union between Norway and Sweden, the matter was taken up again by Carl Johan through a diplomatic communication to Russia in 1816 on the recommendation of the Norwegian Government. This attempt was not successful either.

In 1822, therefore, the Norwegian Government again took up the matter and suggested that the king enter into negotiations with Russia on getting a boundary set up between Norwegian Finnmark and Russian Lappland by specially appointed commissioners from both sides. In accordance with this, a new diplomatic application was made in 1823 in St. Petersburg. This time the Russian government was also prepared to push the matter, and both sides conducted preliminary investigations of the boundary problems.

In Norway, the Storting handled the matter in 1824 (see Storting Negotiations, March 1824, page 107 ff) and set up a special committee with a mandate to recommend proposals on the various questions which came up in this connection. In its report the committee proposed principally that the boundary with Russia should be drawn from the Jakobselv River, to the southwest over a section of Kiölemejaure (i.e., Svanvatnet, Salmijärvi), and further through the Pasvikelv River or Klosterelv River to Gelsonio, where the boundary between Russia and Enare borders on the jointly-owned district of Pasvik. From Gelsonio the new state boundary should follow the old boundary in the northwest by Enare Sogn Parish, approximately 11 fjellmil

[mountain miles] to Golmis-oalve Madda -- Gaettsje. The committee concluded by proposing that application be made to the king requesting that a regular boundary agreement be brought about along these general lines. The Storting agreed unanimously to the proposal (Storting Notification 1911 - 1933, VI, page 363), and in the beginning of 1925 a communication to this effect was directed to the Russian Government. In accordance with a Russian proposal, a Norwegian and Russian commissioner (Colonel Spørck and Lieutenant Colonel Galamine) were sent the same summer to the border districts to investigate jointly the circumstances there. The mission of the Norwegian commissioner, as well as of the Russian commissioner, was to conduct precise investigations and to prepare and sign descriptions and maps of the jointly-owned districts and the international boundary, which could serve as a basis "for the boundary definition which will be set up hereafter between both states." It states also in the instructions that "A careful definition of the old boundary between Sweden and Norway which now constitutes a part of the boundary between Norway and Russia through the peace treaty of Fredrikshamn, should, so far as it concerns the jointly-owned districts, be made the Commissioners' most urgent function."

The Commissioners' inspection took place during July 1925, and on the basis of this they drafted a report and made up a special map: "Carte Topographique des districts communs entre la Norvege et la Russie, avec un projet de delimitation." This map later became a part of the final boundary agreement. According to the commissioners' proposal, the boundary should extend "from Golmis-oalve Madda-Gaettsje along the old boundary between the jointly-owned districts and Sweden across the mountains Reisa-Gora and Reisa-Oive to Gelsomio; from there along the Pasvikely River to Boris and Gleb church, which

with 1 verst of land on either side should belong to Russia; from there in a southeasterly direction to the little lake where the Lakselv River has its source; then to the point on the Jakobselv River where three streams join each other; and from that point should follow the Jakobselv to its mouth in Jakobsbukt Bay."

With a few exceptions this was the boundary line corresponding to the proposal of the Storting committee. First, it seems that the boundary at Galsmo was drawn a bit farther north and west, and second, the boundary line did not go directly from Fiolmojaure to the Jakobselv River, but followed the Pasvikelv River to Boris Glob, which was to be Russian. In the report of the Norwegian commissioner it is stated that it was the express desire of the Russians to keep Boris and Glob church for Russia, which was the reason for this exception. He stated that he had done all that he could and, among other things, suggested moving the church at the expense of the Norwegian State. The Russian Commissioner had, however, during his trip to the jointly-owned districts, received a number of requests to keep this church for Russia, and he was immovable on this point. He stated that the church's age and the fact that it was built by a saint made not only the church itself but also the place, holy "and like a jewel which is useful and is useful in several ways."

Aside from these exceptions, the Norwegian desires with regard to the partition of the jointly-owned districts have, as far as can be seen, complied with the proposals of the commissioners. The commissioners also brought forth a proposal on the arrangement of conditions for the Norwegian and Russian families living in the jointly-owned districts.

The proposal of the Commissioners was very well received both in Norway and in Russia and the Norwegian Government proposed in September 1925 that the king conclude a boundary treaty with Russia on the basis of the proposal of the commissioners and to agree that

the following summer (1926) be set aside for surveying the border and marking it with cairns. With certain editorial changes, the Russian Government also agreed to the proposal.

3. The Boundary Agreement of 1926

The formal agreement between the two countries was signed in St. Petersburg between 2 and 14 May 1926. It was essentially based on the commissioners' proposal and was ratified by the Norwegians on 27 May and by the Russians from 19 June to 1 July 1926. Since the boundary survey which was undertaken in 1947 was based upon the Agreement of 1926, it is of interest here to review quickly the provisions of the Agreement. For further information, see the text of the agreement, which is attached as Appendix 2 of the present proposal.

The main provisions of the Agreement fall naturally into two groups: Articles 1-4 and Article 11 contain the transitory provisions whereby the actual boundary was established, while Articles 5-10 are regulatory provisions which established the future relationship between the border dwellers of both sides.

Article 1 provides that the old boundary line between Norway and Sweden with reference to the treaty of 1751 will specifically be retained as the boundary between Norway and the Grand Duchy of Finland. The circumstances were such that until 1751 there were three different kinds of jointly-owned districts in Finnmark:

1. The Norwegian-Swedish jointly-owned districts of Kautokeino, Arjovarre, Tenoby (Juxby or Eskildby) and Utsjoki;
2. the Norwegian-Swedish-Russian jointly-owned district of Enare (Indiager); and
3. the Norwegian-Russian jointly-owned districts of Neiden, Pasvik, and Peisen.

the following summer (1926) be set aside for surveying the boundary and marking it with cairns. With certain editorial changes, the Russian Government also agreed to the proposal.

3. The Boundary Agreement of 1926

The formal agreement between the two countries was signed in St. Petersburg between 2 and 14 May 1926. It was essentially based on the commissioners' proposal and was ratified by the Norwegians on 27 May and by the Russians from 19 June to 1 July 1926.

Since the boundary survey which was undertaken in 1947 was based upon the Agreement of 1926, it is of interest here to review quickly the provisions of the Agreement. For further information, see the text of the agreement, which is attached as Appendix 2 of the present proposal.

The main provisions of the Agreement fall naturally into two groups: Articles 1-4 and Article 11 contain the transitory provisions whereby the actual boundary was established, while Articles 5-10 are regulatory provisions which established the future relationship between the border dwellers of both sides.

Article 1 provides that the old boundary line between Norway and Sweden with reference to the treaty of 1751 will specifically be retained as the boundary between Norway and the Grand Duchy of Finland. The circumstances were such that until 1751 there were three different kinds of jointly-owned districts in Finnmark:

1. The Norwegian-Swedish jointly-owned districts of Kautokeino, Avjovarre, Tenoby (Jukby or Eskildby) and Utsjoki;
2. the Norwegian-Swedish-Russian jointly-owned district of Enare (Indiager); and
3. the Norwegian-Russian jointly-owned districts of Neiden, Pasvik, and Peisen.

After a year of negotiations, a treaty was concluded in 1751 with Sweden which established the boundary from Hissøy in Østfold to Gømsalvsve Hadda -- Gaettsje, where the purely Norwegian-Russian jointly-owned districts began. The marking of the boundary between Norway and Sweden was undertaken in the years 1756-66, and 348 national cairns were set up. The last of these was Pitsumorast cairn. From there the international boundary went to the terminal boundary point, Gømsalvsve Hadda -- Gaettsje; since this point touched the Norwegian-Russian territory of Nelden, no national cairn was placed there, but only distances and directions were noted. The last section of the boundary line, from national cairn No. 347, marked the boundary between the present Sør-Varanger district (herred) and Utsjoki commune of the Lappmark district.

By the peace treaty of 1809 in Fredrikshamn, the then existing Finland together with a part of Vesterbotten and Lappmark were turned over to Russia, and the boundary treaty which was signed on 8-20 November 1810 implied that from the boundary cairn No. 294 -- Koskimodka (the present tri-state cairn between Norway, Sweden, and Finland) -- Norway's boundary with Sweden became a boundary with Russia (the Grand Duchy of Finland). It is this boundary condition which the Agreement of 1826 expressly confirms in Article 1.

Article 2 then established the boundary all the way to the Arctic Ocean in accordance with the proposal of the commissioners, and adds that where the Pasvikelv River and the Jakobselv River form the boundary between Norway and Russia, the thalweg ("le chenal") of these waters will be considered the boundary line; in the lakes formed by these rivers, the boundary will follow the middle.

In Article 3, Norway specifically surrenders all old claims east of the boundary line agreed upon.

Article 4 prescribes that a regular boundary survey should be conducted as soon as possible and that the cairns be built along the new boundary.

In adhering to these transitory rules, Article 11 provides that Spörck's and Galamine's map from 1825, which had served as the basis for the negotiations, should be attached to the Agreement "to constitute a part of it just as though it had been signed by the named commissioners." The map is in the scale of 1:168,000. It was drawn up without instruments, had very little detail, and both distances and directions were so inaccurate that the whole thing often has little or nothing to do with the actual conditions of the terrain.

Article 5 gave the inhabitants in the former jointly-owned districts a 3-year option, and Article 6 guaranteed them freedom of religion.

According to Article 7, the inhabitants in the jointly-owned districts will retain their previous hunting and fishing rights in the other country's territory. However, this proved in practice to be the cause of local disputes, and the privileges were later precisely defined and limited by the Protocol of 6-18 August 1834. Norway later recovered these privileges, but they are now completely nonexistent.

Reindeer trapping on the other nation's territory was expressly forbidden by Article 8 "in order to prevent in the future those disputes which have been occasioned by the mutual trapping rights existing between the inhabitants of the boundary districts," but stray animals should, however, "without any obstacles, be returned to their owners."

Article 9 regulates the right of traffic, floatage, and fishing in the Jakobselv River and the Pasvikelv River.

Article 10 is a customary sanction paragraph, and Article 12 contains the provisions of ratification.

The Agreement was laid before the Storting in 1927 (see Storting Negotiations 1927, I and IV), and the appropriate Storting committee stated in its report that the documents presented bore witness to the fact "that the most careful measures have been taken to ensure Norway's interests and dignity."

The committee's report ended with an appeal to the king to bear witness to "the appreciation of the Norwegian people for the wise solicitude for the welfare of the Norwegian realm and of which the treaties concluded with foreign powers in behalf of the State and most graciously submitted by the Storting bear the unmistakable impression." This was unanimously adopted (Storting Negotiations 1927, IV, page 549 ff.).

4. Boundary Inspection 1926-1920

In the summer of 1926 a boundary survey and marking were conducted, in accordance with the provisions of Article 4 of the Agreement to the effect that immediately after the ratification "the commissioners appointed by both sides, accompanied by an adequate number of workers, should go to the site to draw up the boundary line as provided in Article 2 and to set up the markers which will indicate this line."

During this first boundary survey the boundary's course in the terrain was marked and described in a protocol which then became the first interpretive document of the Agreement. Since it was decided for the boundary marking of 1947 that the boundary line should be accurately determined and marked in the field in accordance with the description protocol and the boundary maps of 1962, as well as with the documents from the later boundary surveys (see below, section 7), the protocol of 1926 again becomes current, and is therefore included as Appendix 3 of the present proposal.

The boundary marking of 1826 began at Gelmiscaivve Madda-Naettaje, where boundary cairn No. 349 was set up. (Then followed cairn No. 350 on Quellebastamvaara Mountain, cairn No. 351 on Bolomaivve Mountain, and cairn No. 352 on mountain at Dobbelsjaure; all these cairns stand along the present Norwegian-Finnish border.) Boundary cairn No. 353 was built on Reisa-Nora and thereafter the boundary clearing continued to the southeast via the "Mudkevara" (i.e., Krokfjell Mountain) -- the present tri-state point between Norway, Finland, and the U.S.R. (Muotkavaara was established only in 1833 as the northern terminus for the boundary between Russia proper and the Grand Duchy of Finland, and the cairn was built during the subsequent boundary survey in 1846.) From this point the boundary line went forward to boundary cairn No. 354 on "Reia-Varatch" Mountain (Rajavaara-Gronseberget).

"From this point," it is stated in the protocol of 1826, "the line goes in a northeasterly direction, cutting across the Pasvig River south of Hatch Fosson (Gronsefoss Falls), touching the little mountain Reia Njarg, which lies on the eastern bank of the Pasvig River, to the confluence of the Gelsomio River and the Pasvig River. On this mountain, boundary cairn No. 355 was erected." Two rather small sections of land on the east bank of the Pasvikelv River hereby became Norwegian.

By this boundary marking, confirmed by a provisionⁱⁿ the Agreement's Article 2, first paragraph, it is expressly established that the boundary line at Gronsefoss Falls crosses the Pasvikelv River and continues on the east bank to Gelsomio, so that both river banks and the rapids in between belong to Norway. Article 2, second paragraph, provides that only from Gelsomio does the Pasvikelv River form the boundary, and where the thalweg principle will thus apply in accordance with Article 2, fourth paragraph. Today it is no longer

possible to establish with precision the position of the point "Gelsomio" to which the Agreement refers, in which respect the contemporary maps are much too inaccurate and quite inconsistent in the details. There are, however, various bases for the assumption that the actual intention in the Agreement was that the boundary on the east bank of the Pasvikelv River at Grensefoss Falls was to have been carried somewhat further to the east (approximately 1 kilometer), all the way to the Gelsomio River (i.e., Nautesjoki) so that the whole headland between the Pasvikelv River and the Nauteselv River would have fallen to Norway. The boundary marking of 1862 was, however, approved by both the Norwegians and Russians and thereby became finally binding for both parties.

The thalweg principle was used as a basis for the boundary placement both in the Pasvikelv and the Jakobselv Rivers, but does not seem to have been carried through free of exceptions, especially in regard to Skolteholmen and Nivasaari. (On the previous boundary map these two islands are named respectively, "Nakhholmen" and "Nivansaari.") However, it is expressly stated in the protocol that the commissioners intended at these two places also to draw the boundary "along the deepest point." These deviations from the thalweg rule are evidence of pure error.

Article 2 of the Agreement showed how the boundary should be drawn "to the outlet of the Jakobselv River into the Arctic Ocean in the vicinity of Jakobsvik." The question of the sea boundary was not touched upon in the Agreement or discussed by the commissioners, and the last international cairn was built in 1926 at the mouth of the Jakobselv River on a little headland on the Russian side, and was numbered 363.

On the entire boundary extending from Krokfjell Mountain to the sea, a total of 11 main cairns was raised; in addition, 8 unnumbered, so-called "middle cairns" were built on the mountainous section between

the Pasvikelv and Jakobselv Rivers (between boundary markers No. 360 and No. 362).

In 1926 the commissioners (Lieutenant Colonels Mejlaender and Calamine) also drew up and signed a special map to show how the boundary marking was accomplished: "Carte Topographique de la ligne de démarcation, tracée entre le Finmark Norvégien et la Lapponie Russe, d'après la convention de 2-11 Mai 1926." This map, which is in the scale of 1:8,400, is at certain points somewhat more detailed than the map of 1826, but otherwise has the same serious errors in distances and directions.

The boundary was next surveyed in 1846. Aside from the customary clearing of the boundary, the cairn on Krokfjell Mountain was built. At the same time a special map ("plan") was drawn up and signed; this was to show the position of the last national cairn, No. 363 at the mouth of the Jakobselv. The Norwegian commissioner further prepared a "rough sketch of the Norwegian boundary from the Jakobselv to the Tanaelv Rivers."

In accordance with a proposal from the commissioners who conducted the boundary survey in 1846, a Declaration was signed, 20 May to 1 June 1847, by Norway and Russia on a regular boundary survey every 25 years. In accordance with this, such boundary surveys took place in 1871 and 1896. (A special inspection for the purpose of, among other things, the restoration of several cairns was known to have been conducted in 1857. In addition, a local boundary survey was conducted in 1912 from Neiden to the Tana waterway.) In the boundary survey of 1896, two middle cairns were built on Holmfossøya Island.

All the Norwegian-Russian boundary cairns from 1826 on had heart stones on which the cairn's number, the year it was erected, and the initials of the state were carved. On the cairns which were erected

in 1896, however, only the year was indicated. At approximately 20 meters' distance on either side of the individual cairns so-called "outliers" (smaller cairns with heart stones showing no inscription) were set up to indicate the direction to the next cairn.

The boundary clearing across the country was only cut 6 ells or 5 arshin. (approximately 4 meters) wide in 1826, but since such a boundary clearing was almost invisible from a distance, the width was extended in 1896 to 8 meters.

The protocol of 1896, which proved to be of some interest during the boundary marking of 1947, is printed as Appendix 4 to the present proposal. On the other hand, the documents from the protocols of 1846 and 1871, deleted here for the sake of saving space, also contribute to elucidation of the boundary conditions.

On Russian proposal, "a secondary and supplementary marker" was placed on the Norwegian side of the mouth of the Jakobselv River in 1896 in order to avoid the misunderstandings which could arise because of the position of international cairn No. 363 on Russian territory east of the boundary. It is stated further, however, in the protocol: "One should take especial notice that the setting up of this marker does not in any way alter the provisions of the Agreement of 1826." Thus it was herewith again precisely stated that the boundary line followed the thalweg in Jakobselv River all the way to the sea.

In the protocol of 1896 it was further expressly stated that the boundary -- to the disadvantage of Norway -- did not follow the thalweg at Nakholmen and Nivansaari. "Since this map (i.e., of 1826) gives only a much too general and inaccurate presentation of the river and its lakes, the description is stamped by this. Places are also found where the general principle of the deepest channel could not

be adhered to...." Since, however, the boundary line both at Nakhholmen and at Nivansaari as previously mentioned, was in conformity with the boundary documents of 1826, the commissioners limited themselves to pointing out the conditions without recommending any boundary regulation.

The commissioners from both 1846 and from 1871 had noted in their reports that there were very serious errors both in direction and in distances on the boundary map of 1825, which in accordance with Article 11 of the Agreement was the only official boundary map. In the boundary survey of 1896, the commissioners, therefore, received instructions in connection with the boundary inspection to draw up a map over the whole boundary strip, 1 verst wide and in the scale of 1:42,000, using instruments, and, in addition, to draw up more detailed map sketches in the scale of 1:8,400 of the terrain around every international cairn. This was also done, and the result was a correlated map set which was very good with regard to the conditions and the needs of the time and which cleared up many of the problems which the map of 1825 had omitted. At the same time, the thalwegs in the rivers were more closely investigated. The map is, however, only partly measured with instruments and does not satisfy modern demands for accuracy.

While both the maps and the protocol of 1896 were approved by the Russians, only the maps were approved by Norway (by government resolution of 19 November 1904). In 1907, therefore, the Russian Foreign Ministry asked Norway/also to recognize the protocol. The prop

proper Norwegian authorities could not at that moment (the Norwegian Foreign Ministry had just been established one year earlier and was still in the middle of its own internal organizational problems) see how there could be any disagreement between the Protocol of 1896 and the Agreement of 1826. Under these circumstances, in order not to

risk disturbing anything in the Agreement, while still unprepared, Norway therefore decided for the sake of safety not to make any formal approval of the protocol. That notwithstanding, the protocol naturally still has great factual importance as an interpretive document to the approved map set.

According to the regulation providing for a boundary survey every 25 years, the next Norwegian-Russian boundary survey should have taken place in 1921. Before this time, however, Russia had ceased to be Norway's neighbor as a result of the World War, 1914-18, and the peace settlement after the war.

5. The Boundary Conditions with Finland, 1920-1939

Immediately after the Russian October Revolution (25 October - 7 November 1917), Finland was proclaimed an independent state. By the peace treaty between the new Finnish Republic and the Soviet Union, signed in Dorpat on 14 October 1920, the Soviet Union recognized Finland "within the boundaries of the Grand Duchy of Finland, as an independent and self-subsistent nation," and according to Article 4 of the treaty, the Russian Pechonga territory was at the same time also turned over to Finland. It was called Petsamo in Finland. (This territory, as it was delimited in Articles 2 and 4 of the Dorpat treaty, was not exactly the same as the Russian part of the jointly-owned districts which were partitioned in 1826, since the eastern boundary of the jointly-owned district went a little farther east than Vaidas Guba. Likewise, the map of 1925 did not reckon the southern boundary of the jointly-owned districts farther south than approximately the 69th parallel.) The previous Norwegian-Russian boundary according to the Agreement of 1826 became therewith a Norwegian-Finnish boundary.

In 1921 the Government of Finland decided to open boundary negotiations with Norway. In Norway, the Ministry of Foreign Affairs had as early as 1920 initiated thorough investigations of the various

questions which the new boundary conditions raised. The proposal on Norwegian-Finnish negotiations was submitted to the Storting as Storting Proposal No. 32, 1922, and on 5 April 1922 (cf. Storting Report No. 144-1922) Storting agreed "that the Government should open negotiations with Finland on various border questions which have come up as a result of Finland's taking over the Pechenga territory."

The negotiations were opened in May 1922 and continued until February 1924. (The Norwegian delegation was appointed by government resolution of 28 April 1922 and consisted of Prime Minister Gunnar Knudsen, chairman; Supreme Court Justice J. A. Rivertz; Director of Timber Floatage Johs. Johannesen; and former bureau director in the Ministry of Foreign Affairs, Eivind Blehr. In the Resolution of 7 July 1922, Gunnar Knudsen withdrew from the delegation, while Rivertz became chairman, and the provincial governor of Finnmark, Hagbarth Lund, was appointed as a new member.) In addition to the proposal for a new boundary agreement, the commission also prepared special treaty drafts concerning traffic, rights to waterways, timber floatage, and fishing, which it is not necessary to go into in this connection.

In regard to the delegation's mandate, it is stated in Storting Proposition No. 32, 1922, that it was the assumption of the Ministry of Foreign Affairs that there would be, during the negotiations, "occasion to take up the question of regulation of the international boundary in the Pasvik valley." In connection with this, the Norwegian delegation, during the accompanying negotiations, proposed regulation such that the boundary be drawn to correspond with the Norwegian proposal of 1926: from Svanvatn through Knotsjarvi to the

Jakobselv's sources. The Finns, however, were unwilling to discuss such a boundary regulation because the Norwegian side could propose no corresponding territorial compensation (exchange) for Finland. Neither were they successful in altering the old deviations from the thalweg principle at Nakholmen and Ilvansaari. The result of the negotiations on the course of boundary therefore remained a complete status quo with regard to the agreement of 1826.

By Government resolution of 26 April 1924, the Commission's draft was approved, and on 28 April the "Agreement between the Kingdom of Norway and the Republic of Finland on the international boundary between Finnmark Province and Petsamo District" was signed. This agreement superseded the previous Norwegian-Russian Agreement of 1826 for the sector of land from Krokfjell Mountain to the sea.

The Agreement of 1924 contained 9 Articles:

Article I established that the old Norwegian-Russian boundary should be retained "just as it was surveyed in the Norwegian-Russian boundary surveys and boundary adjustments and in conformity with the maps drawn up in 1896 in connection with the clearing along the boundary. It is stated in the last paragraph that in those sections of Pasvik where the boundary course is not clearly shown on the appropriate map, the boundary is to follow "the middle of the thalweg."

With regard to the course of the boundary in the Jakobselv River, Article II contained the special provision that the boundary, up to the mouth of the river, is always to follow "the middle of the river's thalweg and the middle of the lakes formed by the river." This also corresponds completely with the Agreement of 1826, but since the

Jakobselv River is not naturally very regular, and since minor changes in the river bed take place ^{relatively} frequently, it was not practical in 1924 to tie the boundary to the then 27-year old map of 1896, "since it is already obsolete because of the activity of the water," it is stated in the delegation's report. Instead it was decided that a new map of the Jakobselv River be prepared (Article VI).

"To prevent change in the riverbed or the course of the river through excavation or deposition" the interested nation could undertake the necessary damming [one-track mind] or other measures on its own territory, but such measures must "not act upon the water conditions in a manner damaging or inconvenient to the other nation or its inhabitants" (Article IV).

The matter of the sea boundary outside the Jakobselv River, which had never been discussed by Norway and Russia, was attempted to be solved in Article III of the new Agreement by drawing the partition line between the sea territories of Norway and Finland would be "in such a manner that each point of the line would lie equidistant from the coasts of the two states, measured from the nearest point not constantly covered by the sea--on the mainland, as well as on islands, islets, and skerries."

It was further agreed that there should be a new boundary survey as soon as possible (Article V), instead of the boundary negotiations which should have taken place in 1921, and that thereafter there would be a regular boundary inspection every 25 years (Article VII).

Article VIII contains the usual arbitration clause, and Article IX contains the provisions of ratification, etc.

A concluding protocol was attached to the agreement; this discussed the legal status of the boundary inhabitants with regard to the territory of the neighboring country, and which put an end to various antiquated usufructs.

With Storting Proposal No. 65, 1924, the whole matter was laid before the Storting, which according to Storting Report LXVIII, 1924, unanimously approved for ratification on 6 August 1924. The ratification documents were exchanged in Helsinki on 26 September 1924.

The boundary survey, in accordance with Article V, was conducted the following year, 1925. Most of the old national cairns (and outliers) were rebuilt, and where necessary, were provided with new heart stones, so that all the cairns had a more uniform appearance than before. All the old heart stones on the side which was previously Russian were provided the inscription "Suomi", while retaining their earlier date and number; the new heart stones were given the date 1925. Eight new middle cairns were also built (in the Boris Gleb area and in the mountainous sector between the Pasvikelv and the Jakobaelv Rivers: 2 at Skoltfoss Falls, 3 at Skafferhullet, and 1 each at Serdivatn, Aborvassfjell and Hundaasen) so that the total number of international boundary cairns from Krokfjell Mountain to the sea now totaled 30.

During the boundary survey the Finns proposed that a new large-scale map of the Pasvikelv River be prepared. The Norwegian commissioners thought that such a map would be so costly that the expense would hardly correspond to the need. They concurred that for those places along the Pasvikelv River where the map of 1896 did not give adequate information, map sketches should be drawn by simple methods and without triangulation. (Such maps were drawn of Fjaervatn, Jordanfoss, Vaggatem, and Svanvatn. In addition, the old maps were provided with special sketches of Gransevatn, Skogfoss, and Holmfoss.) The Finnish commissioners did not, however, think that this was adequate and stated in the protocol that to this extent the boundary survey "did not satisfy the conditions demanded of it by Finland, and that a new boundary survey based on new maps should be taken of the whole

waterway." The Norwegian commissioners would go no further than to recommend in the protocol, "on the basis of the experiences during the boundary survey with regard to the map of 1896, that the proposal of the Finnish delegates on the marking of the boundary's course in the waterway and the maps of Norwegian holdings, in that connection, be brought up for review." However, no such Norwegian-Finnish charting project was ever done.

The Ministry of Foreign Affairs announced the following concerning the boundary as it follows the Pasvikelv River in Storting Proposal No. 32, 1922:

"It is recommended that the inhabitants of both countries be given clear and unmistakable directions by their respective authorities as to which country owns the various islets and islands. A great many of these have grazing lands and hay fields of great importance to the economy of the population, and it is vital that every opportunity for dispute between the boundary inhabitants on rights of ownership to such islands be removed."

In Article V of the Agreement, concerning the mandate of the commissioners, it was decided that they should erect "new markers according to need." It was considered impractical to set up markers on land to establish the boundary in the rivers, since, because of the terrain conditions, there would be too many markers, and, moreover, it would be difficult to place them so that they answered their purpose and were an effective guide for those who traveled the river. They were also afraid that the cost would not correspond to the need. Both parties, however, agreed that the ownership of the various islands and islets in the water-way must be clarified. Therefore in 1925 special

"islet signs," showing whether the islet was Norwegian or Finnish, were set up on these islets.

It had been provided in Article VI of the agreement that entirely new maps of the Jakobselv River should be made. This map was drawn up in scale of 1:10,000 (a single map of the outlet itself and the sea area beyond was drawn up by each party over a larger area, in scale of 1:20,000). During the survey, the thalweg also was determined and indicated on the map.

The commissioners did not succeed in agreeing in 1925 on the boundary's course in and around the river mouth. This question was therefore left open, and the same held true for a decision, in conformity with Article III, on the sea boundary outside the Jakobselv River mouth (see the Protocol of 1925, Sections VII and VIII).

Negotiations on these questions were taken up again in 1931, and the matter was solved by the supplementary protocol of 12 September 1931. (Aside from the new negotiations, in 1927-30 a newspaper polemic was in progress between the Norwegian and the Finnish first commissioners who were at the boundary marking of 1925; see: Head Director of the National Surveying Board in Finland, Kypsti Haataja, J.U.D.: "Questions Juridiques surgies lors de la Revision de la Frontiere Finlandaise entre le Golfe de Bothnie et l'Ocean Glacial" -- Fennia 49, No. 1, 1927 -- and Director of the Norwegian Geographic Survey, Major K. S. Klingenberg: "Practical and Juridical Questions Arising from the boundary survey between Norway and Finland, 1925" -- Norwegian Geographic Publication, 1930). The protocol established 11 points through which the boundary line should be drawn in the disputed area, and, in addition, gave "freedom to anchor and lie" to the vessels of both nations on both sides of the boundary

in the mouth of the river itself. The actual marking with regard to the supplementary protocol was accomplished only in 1939, when 20 "directional markers" were set up on the land in such a manner that the guide lines intersected at the 11 established boundary points. This marking was at the same time entered on a revised copy of the boundary map of 1925; likewise a special protocol and description were signed by both parties.

The boundary documents from 1925 and 1931 were "approved as valid until the next boundary visitation" through the exchange of notes on 15 June to 16 July by both countries.

Aside from the actual boundary agreement of 1924, in order to regulate the conditions between neighboring countries along the border, the following agreements between Norway and Finland were concluded before World War II:

Agreement of 3 March 1922 on mutually agreeable measures for preventing reindeer from crossing the boundary between the two nations, with the Supplementary Protocol of 7 June 1922; later superseded by:

Agreement of 5 November 1935 on the measures for the prevention of reindeer from crossing the border between the two nations.

Agreement of 28 April 1924 on traffic on the Pasvikelv and Jakobselv Rivers.

Agreement of 14 February 1925 on international waterway rights in the Pasvik and Jakobselv Rivers.

Agreement of 14 February 1925 on timber floatage in the Pasvik with the corresponding statute of the same day.

Fishing rules for the Pasvikelv River; Fishing rules for the Jakobselv River; both of 3 May to 21 August 1925, in accordance with the exchange of notes on 14 February 1925; the first-named rulings

were later superseded by:

Agreement of 21 April 1938 on new fishing rules for the fishing area in the Pasvikely River, with the corresponding fishing rules of 22 April.

Exchange of notes, 19 December 1925, on traffic and transit along the lower reaches of the Pasvikely River.

Supplementary agreement of 21 July 1937 to the commercial treaty of 11 November 1930 on the adjustment of boundary commerce in the Norwegian-Finnish boundary districts.

The provision in Article VII of the boundary agreement for a new boundary survey 25 years from 1925 was not consummated, since Finland gave up the Petsamo territory to the Soviet Union in 1944.

6. Boundary Conditions during the War, 1939-1945.

During World War II, Finland and the Soviet Union went to war with each other twice.

The first of these armed conflicts, the so-called "Winter War," 1939-1940, caused no alterations in Norway's boundary conditions. During the war there were also military operations in the Petsamo territory, but Norway's boundary was not violated, and Article 5 of the peace treaty of 12 March 1940 confirmed the transfer of the Pechenga District to Finland (Dorpat Peace Treaty) and provided that the Soviet Union should withdraw all its troops from this area to permit free transit for persons, goods, and air traffic to and from Norway.

On 27 June 1941, however, a new war broke out between Finland and the Soviet Union (later extended to include a group of the allies of the USSR in the war against Germany). Hostilities were ended by the armistice of 19 September 1944, which in Article 7 provided that Finland should return the Petsamo territory to the Soviet Union. This territory had been "voluntarily delivered to Finland by the Soviet

Union in accordance with the peace treaties of 14 October 1920 and 12 March 1940." This restitution was confirmed in the final peace agreement of 10 February 1947, which, after ratification, went into effect on 19 September 1947. The old Norwegian-Russian boundary relations up to 1920 were hereby re-established.

During the war against Germany, in which Norway and the Soviet Union were allied, the Soviet troops, by agreement with the Norwegian Government, advanced across the northern border in October 1944 and drove the German occupation forces out of East Finnmark. After the war was finally ended on 2 September 1945 with the capitulation of Japan, the remainder of the Soviet troops were withdrawn from Norway during the course of the following weeks. The withdrawal was completed on 25 September 1945.

The new Finnish-Soviet boundary was surveyed and marked in the summer of 1945; the boundary documents were signed on 26 October 1945, and confirmed by exchange of notes on 19 February 1946. The terminus of the new boundary was the boundary marker on Krokfjell Mountain (Muotkavaara) which thereby became the tri-state cairn between Norway, Finland, and the Soviet Union. When the Finnish-Soviet boundary marking reached this point in August 1945, a Norwegian representative was therefore called together with a Finnish and a Soviet commissioner to approve the position of the boundary marker in relation to Norway. Later a special tri-state protocol for this boundary marker was signed on 26 October 1945 by the representatives of the governments of the three countries. The protocol was announced in Norway in "Agreements with Foreign States" 1946, pages 11 ff.

On 3 February 1947, however, a new agreement was made between Finland and the Soviet Union (ratified 18 April 1947) "on the incorporation into the Soviet Union of that area at the Jämskoski hydroelectrical station and the Niskakoski regulating dam, now owned by the Republic of Finland" i.e., that part of the Pasvikelva River (Patsa-joki) and the river's fluvial basin which lie south of Gransofoss Falls. The boundary between Finland and the Soviet Union as far as Krokfjell Mountain was hereby altered. The new boundary sector was surveyed and marked in the summer of 1947, and this time also a Norwegian representative participated in the inspection of the boundary marker on Krokfjell Mountain. A new tri-state protocol to replace the protocol of 1945 was signed on 3 December 1947 by the representatives of the three countries' governments. This protocol also will be announced in "Agreements."

Neither these tri-state protocols nor Finland's restitution of the Petsamo area, have visibly altered any of Norway's territorial rights, since it is a standard rule that when an area is turned over from one state to another, it is ceded with the boundaries it has with a third state as provided by agreements then in force.

The courses of the boundary between Norway and the Soviet Union therefore presented no problem in itself, but naturally it was necessary that ^a formal treaty between the two countries be concluded. In order to have these questions discussed and solved, the Norwegian Government sent a communication in the fall of 1945 through diplomatic circles to the Soviet Government, proposing that a formal boundary treaty between the two countries be concluded. In the same connection, it was proposed that an attempt be made to regulate by means of special agreements the other boundary conditions and neighbor-relations along the common international boundary, for example traffic, floatage, and fishing in the boundary rivers.

7. The Negotiations in Moscow in August 1946

The actual negotiations between Norway and the Soviet Union on the boundary arrangement first started in the summer of 1946, since the Soviet Government in a note of 2 July 1946 to the Norwegian Embassy in Moscow proposed that a Norwegian delegation be sent to Moscow to discuss the practical institution of a new survey of the boundary on the basis of the boundary survey of 1926. The Norwegian Government declared itself agreeable to the proposal, and by the Government Resolution of 19 June 1946, altered by the Government Resolution of 15 November 1946, there was appointed a delegation, the mandate of which was "to bring into formal order the treaty on the international boundary between Norway and the Soviet Union

through negotiations with the Soviet Government, and in this connection to take part in a joint Norwegian-Soviet survey of the boundary."

The following were appointed members of the Delegation:

Provincial Governor of Finnmark Hans Gabrielsen, chairman;

Director of the Norwegian Geographic Survey, Kr. Gleditsch;

Director of Timber Floatage John. Johannessen;

Bureau Director in the Ministry of Foreign Affairs Eigil Nygaard;

Lieutenant Colonel H. Arede Holm;

Secretary in the Ministry of Foreign Affairs Knut Aars, the Delegation Secretary.

Negotiations with a corresponding Soviet Government delegation took place in Moscow during the period 2-14 August 1946. The Soviet Delegation was composed of the following:

Counsellor in the Ministry of Foreign Affairs, I. V. Mayevskiy, chairman;

Colonel M. A. Kraskovets;

Colonel M. V. Petrunkin;

Captain N. I. Pakhomov;

Engineer-Major N. M. Disskiy;

Attache in the Ministry of Foreign Affairs, V. S. Chebotarev.

These two delegations established themselves in their first meeting on 2 August 1946, in accordance with their Governmental authorizations, as "The Joint Soviet-Norwegian Commission for the Marking of the International Boundary between the USSR and Norway."

The commission adopted the following main plan of work, in accordance with a proposal by the Soviet Delegation:

I. Negotiations on a more detailed moulding of the basis for the Norwegian-Soviet boundary survey, together with discussion and adoption of the necessary technical precepts for the accomplishment of the work.

II. Carrying out the field work.

III. Subsequent office work where the documents (maps, etc.) from the boundary survey would be examined, gone over, checked, and reproduced, and the necessary diplomatic documents prepared and signed.

IV. Submission of the prepared documents to the governments of the two countries for approval.

During the negotiations in Moscow, full agreement was reached between the delegations, both on the basis for a new boundary survey, and on the manner in which the boundary survey should be executed.

Meeting protocols were kept of each of the official meetings of the Joint Commission and were signed by both parties. These meeting protocols, thirty in all plus a concluding protocol, are included as Appendix No. 5 to the present proposal.

The Soviet proposal that the boundary survey of 1926 be used as the basis for the discussions between the two delegations was, as mentioned above, accepted by the Norwegians before the negotiations. In the meeting of the Joint Commission on 6 August 1946 there was adopted a "Regulation for the Joint Soviet-Norwegian Commission for the Marking of the International Boundary between the Soviet Union and Norway" (attachment to the Meeting Protocol No. 3), which more closely defined the basis on which the actual establishment of the boundary would take place.

This Regulation established in Article I, Point 1, that one of the duties of the Joint Commission was "to establish the international boundary between Norway and the Soviet Union to correspond

with the old Norwegian-Russian boundary." In order to accomplish this survey, the Commission - with respect to Article II, paragraph 1 of the Regulations - was to "establish the boundary line with precision and to mark it on the site in accordance with the descriptive protocol and the boundary maps for the Norwegian-Russian boundary of 1826, together with the documents from the later boundary surveys". These "documents from the later boundary surveys were more closely defined during the commission's further negotiations: as a basis, the material from the Norwegian-Russian boundary survey of 1896 was to be utilized, and later topographical measurements of the boundary were to serve as supporting material.

By this decision the Joint Commission had adopted exactly the same principles for establishing the boundary line in the territory as those in effect since the partition of the jointly-owned districts in 1826 and which also had been repeated in the Norwegian-Finnish Agreement of 1924. Within rather narrow limits, however, the Commission was to be able to permit slight deviations from the main principle with reference to Article II, Paragraph 2, of the Regulations which read as follows:

"The Joint Commission can, in exceptional cases, allow slight deviations one way or the other, depending on local conditions."

This decision was motivated out of regard for the Commission, so that it would not at all times be forced slavishly to follow the course of the previous boundary line in the terrain if this boundary line obviously ran inappropriately, as for example, if the boundary in the waterway divided a worthless little skerry or rocky island

between two countries. The Joint Commission was nevertheless cognizant of the fact that inasmuch as the boundary this time was to be determined by accurate measurement with modern instruments, it might prove necessary in individual cases to adjust the boundary course in relation to the boundary line indicated on the older maps, in order that the boundary course might run in exact conformity with the adopted principles.

As regarded the purely practical effectuation of the boundary survey, the Soviet Delegation suggested that for the marking and charting the same methods the Soviets had employed on the other parts of its very long frontier. These methods, which will be more closely described in the following, were far more thorough and exact than those Norway had used during previous boundary surveys, and they were consequently considerably more costly to carry out.

The Norwegian Delegation therefore proposed that a simple marking method be used during the boundary survey, asserting that the marking of the boundary in accordance with same principles employed before on the same strip should continue to be completely satisfactory from a technical viewpoint. The Soviet Delegation maintained, however, that it was absolutely necessary to mark the boundary in such a manner that the danger of inadvertent boundary transgressions between the two countries be reduced to a minimum, and the Soviet Delegation did not consider the earlier methods satisfactory for this purpose.

As regards the charting work, there was agreement between the two Delegations that new maps ought to be drawn up on the border districts. During the Norwegian-Finnish boundary survey in 1925, the Finns, as previously mentioned, always kept insisting on new charting of the boundary districts along the Pasvikelv River, because the main map

series from 1896 did not satisfy modern demands for accuracy. The combined map series of the joint boundary had after a time become a completely haphazard patchwork of maps prepared at different times, in various scales, and with varying accuracy, so that there was a definite need for a new consecutive series of maps for the entire length of the boundary.

The Norwegian Delegation found therefore that all in all the advantages in approving the Soviet proposal on methods of procedure for the boundary survey, including complete recharting along the boundary, were so important that it could not be opposed on economic grounds.

In accordance with this, the Joint Commission discussed and adopted the following Instructions for the practical execution of the work in the meetings at Moscow:

(a) "General Instructions for the Joint Norwegian-Soviet Sub-commissions for the Marking of the International Boundary Between Norway and the Soviet Union" (Attachment No. 1 to the Meeting Protocol No. 5).

(b) "Instructions for Topographic-Geodetic Measurements for the Marking of the International Boundary Between Norway and the Soviet Union" (Attachment No. 2 to Meeting Protocol No. 5).

(c) "Instructions on the Method of Procedure for Setting Up Boundary Markers on the International Boundary Between Norway and the Soviet Union" (Attachment No. 6 to Meeting Protocol No. 5).

The main contents of these Instructions were the following:

A. The Mixed Norwegian-Soviet Subcommissions

The two delegations agreed that while the field work was being carried out on the common boundary, the Joint Commission must be present in the boundary districts to supervise the work and to settle any differences of opinion which might arise. The daily supervision

of the marking and charting work would, however, be delegated to the Joint Norwegian-Soviet Subcommissions, each consisting of a chairman, two members, and a secretary from each country (cf. Meeting Protocol No. 1). In the Instructions for the Subcommissions, there was further adopted a definite work area for each Subcommission, since the approximately 196 kilometers of boundary were divided into two almost equal parts--the southern and the northern boundary sectors. The first Subcommission, for the southern sector of the boundary, was to carry out all the work on the sector from Krokfjell Mountain to Trongesund, while the second Subcommission, for the northern sector of the boundary, was to be given the responsibility of carrying out the work from Trongesund to Varanger Fjord (cf. Article IV of the Instructions). (The boundary between the two sections was changed from 69 degrees 30 minutes north latitude -- Trongesund -- to 69 degrees 32 minutes north latitude. The concrete duties falling on the Subcommissions were indicated in Article V: they were to mark the international boundary to correspond with the old Norwegian-Russian boundary, to prepare protocols, and to determine the grid coordinates for each individual marker, as well as to prepare descriptive protocols for the boundary course within each work sector. Furthermore, it was the duty of the Subcommissions to ensure that topographical maps were prepared in scale 1:25,000 of a 0.5 kilometer wide strip on each side of the boundary line.

According to Article X, the Subcommission may also deviate in exceptional cases to one side of the boundary or the other, when dictated by local conditions. Every deviation must, however, be immediately reported to the Joint Commission.

The Subcommissions must likewise immediately report all points of contention not solved by the Subcommissions to the Joint Commission.

The working arrangement within the respective Subcommissions was regulated in Article IX of the Instructions. In the first Subcommission, the Soviet Delegation had the responsibility for the organization and performance of the field work and the office work. (The person directly responsible to the Joint Commission was the chairman of the delegation.) In the Second Subcommission, the Norwegian Delegation had the same responsibility for the performance of all work.

The duties of the Norwegian Delegation in the First Subcommission and of the Soviet Delegation in the Second Subcommission were purely of a checking nature: checking in the field to see that the work carried out by the responsible party was in accordance with regulations.

In each section it was the performing party which procured the necessary personnel for clearing the vistas, setting up the boundary markers, doing the technical surveying, as well as all the other work connected with the marking and charting of the boundary. At the conclusion of its work, each Subcommission was to submit to the Joint Commission all the boundary documents prepared in accordance with Article V of the Instructions, namely the original map of the border area, the descriptive protocol with attachments, and the boundary marking protocols.

B. The Technical Surveying Work

With regard to the new charting of the boundary area, the duties of the Joint Commission, according to Article I, Point 4 of the Commission's Regulations, were:

"The preparation of topographical maps in the scale of 1:25,000 of a strip along both sides of the boundary and the determination of the grid coordinates for the boundary markers according to a common system."

Detailed technical directions for map charting and the technical surveying work connected with it are provided in the special instructions for the topographic-geodetic work. These instructions stated in Paragraph 7 that topographical maps in the scale of 1:25,000 were to be prepared of the whole boundary area to a width of 1 kilometer (0.5 kilometers on either side of the boundary line). Where the boundary went across water (lake or river) more than 1 kilometer wide, a map was to be prepared of both sides of the waterway to a depth of 100-150 meters. The actual execution of the charting work was delegated to the respective Subcommissions and their technical personnel. The Commission resolved in addition that each party was to carry out its topographic-geodetic work according to its own methods, cf. Section 5, Paragraph 1 of the Instruction, since it would have meant great practical difficulties to attempt to devise a whole system of common rules for the technical execution of the surveying work.

Consequently, in the southern sector of the boundary, those topographical surveying methods commonly used in the Soviet Union were to be employed; in the northern sector, the corresponding Norwegian methods were to be employed. In order that the result would be a reasonably uniform map series of the whole extent of the boundary, certain common principles for the technical surveying work were prescribed in the Instructions. Section 5 of the Instructions prescribed that in both boundary sections a polygonal traverse be laid along the boundary line, such that the points of the polygon fall on the boundary line itself, midway between the boundary posts. Where the boundary crossed over water, the polygonal traverse was laid along one of the shores. The distance between the points of the polygon was to be measured twice; the difference between the forward measurement and the backward measurement not to exceed $1/1,000 - 1/700$ of the measured length, depending on the type of terrain. The difference between two measurements of the angle at a traverse station was not to exceed 30 seconds. The polygonal traverse was to be bound in with the

triangulation of the area. In Section 6 of the Instructions it was prescribed that the results of the polygonal measurements should be set up in sketches of scale 1:25,000, the angles indicated at the traverse stations, and the distance between the polygon points.

For each of the boundary markers, grid coordinates were to be determined (by rectangular Gauss-Krüger coordinates in 6 degree zones on Bessel's ellipsoid, Pulkova System) on the basis of triangulation of the area.

Geographic coordinates were also to be determined for the terminus of the maritime boundary in the mouth of the Grense Jakobselv River as well as for the traverse station on the maritime boundary (cf Section 2 of the Instructions). The terminus was to be marked with a sea marker (buoy stake) and its position indicated by sighting points (alignment markers) on land.

More closely defined rules are given in Section 8, for the charting of maps. Each party is to use its own conventional signs and symbol. On those maps drawn by the Soviets of the southern boundary area, the conventional Soviet signs are thus to be used. In the same way, the Norwegian signs should be used in maps of the northern sectors.

C. The Technical Marking Work

The Instructions for setting up boundary markers, adopted on the basis of a proposal by the Soviet Delegation, established a method of procedure for the marking of the international boundary which signified the introduction of an entirely new system of Norwegian boundary marking. While Norway's land boundary had previously been marked by stone cairns set up on the boundary line, and by cleared vistas, it had now been decided that the boundary between Norway and the Soviet Union were to be marked by pairs of wooden boundary posts -- heights above the ground, 2.06 meters, square with a cross section 22 by 22 centimeters, and set up on either side of the boundary line at a distance of 2 meters from it. Only when the material for wooden posts was not available would stone posts or stone cairns be used. In Section 8 of the Instructions it was prescribed that in the forest along the boundary line vistas 8 meters wide (4 meters on either side of the boundary line) were to be cut, figured from the branches of the trees.

With regard to Section 3 of the Instructions, the boundary markers were to

be close enough to each other as to eliminate any difficulty in seeing from one marker to another. At the boundary traverse stations, besides the two boundary post, smaller wooden stakes (polygon posts) were to be set up on the boundary line at the station itself or circles were to be cut in the rock with the centrum at the station. Boundary markers were to be set up everywhere the boundary crosses roads or waterways. Where the boundary follows a waterway (river or lake) one post was to be placed on each shore.

The erected boundary posts were, according to Section 6 of the Instructions, to be painted, numbered, and marked with the national coat of arms.

A protocol was to be prepared for each boundary marker in which the precise placement of the marker was described, and with data on of grid coordinates in the axis system adopted for each boundary marker. Likewise, the distance from one boundary marker to the next was to be indicated, as was also the azimuth between the markers. On the last page of each boundary marker protocol, a so-called "outline sketch" (map sketch) was to be drawn which showed the placement of the markers in question and details of the surrounding terrain, of Section 7. Furthermore, a photograph of the boundary marker was to be printed on the back page.

Marking with pairs of wooden posts naturally affords greater technical advantage than the system previously used for Norway's boundaries, since it reduces the risk of inadvertent trespassing by indicating the boundary line as clearly as possible. On the other hand, this system is much more complicated to execute than the older marking system and in addition is expensive. As mentioned, however, the Norwegian Delegation decided, with the consent of the Ministry of Foreign Affairs, that the Soviet proposal should be accepted because of the advantages it afforded.

The system adopted in Moscow for making and charting the international boundary necessitated especially careful preparations before the field work could be started. Approximately 800 marker posts had to be prepared and delivered, and the technical charging work has to be planned with extensive

coordinate conversion in order to have the two existing triangulations of the boundary areas under consideration (Paavikely and Jakobselv triangulations) converted to the same base, and then converted again to the Pulkova system. Since, because of climatic conditions, it was too late in the year to begin the boundary survey after the conclusion of the negotiations in Moscow (the survey could have begun on 1 September at the earliest), the Joint Commission decided to postpone the field work until the summer of 1947.

The Norwegian Delegation deemed it practical, however, for the Commission to make a short survey trip in the boundary districts as early as 1946, immediately after the close of the negotiations in Moscow, and submitted a proposal to this effect, assuming that by such an inspection the Commission could more easily ascertain those practical rules which would have to be devised before the boundary survey of 1947 could take place. The Soviet Delegation, however, would not go along with this proposal. It maintained that such an inspection was not especially necessary, as the adopted instructions sufficiently accurately established the procedure for all work to be executed in the field. (Meeting protocol No 4, 1).

Upon conclusion of the Commission's negotiations in Moscow, it was decided that another meeting should be held in March 1947. The purpose of the new meeting was to discuss various refinements in the instructions adopted and, further, to devise such other technical instructions as were necessary. Moreover, an accurate plan (schedule) for the work in the field was to be prepared.

After the Delegations's return from Moscow, the results of the negotiations were laid before the Government, and the Joint Commission's Regulations -- which were to form the main basis for the entire boundary marking project -- were approved by the Government Resolution of 20 December 1946.

8. The Preparatory Work of the Boundary Delegation before the Negotiations in March 1947

Immediately after its return from Moscow, the Norwegian Delegation made an inspection of the boundary from Grensefoss Falls to Jakobselv. The purpose

of this inspection was primarily to study the local conditions along the boundary, especially at those places where doubt might arise during the boundary survey as to the course of the boundary line.

The delegation signed a contract with the State Sawmill and Milling Works at Elvenes in Bør-Varanger on the manufacture of the necessary number of boundarymarker posts in the stipulated size. It was important that the posts be cut as quickly as possible, in order that they might be shipped out on the winter roads to the places where they were to be erected.

The Delegation further investigated the various possibilities in the boundary district for transporting the labor force and other personnel, with a view toward the future field work and the matter of quarters for the Norwegian Sub-delegations with their personnel. As regards the Boundary Delegation itself, it was decided during the negotiations in Moscow that this like the Soviet Delegation in the Joint Commission, would have a permanent seat "in the vicinity of those places where the Subcommissions are working". During the inspection in Finnmark the Delegation established itself at the Skogfoss Tourist Station in the Pasvik valley as a regular headquarters; the Tourist Station contained room for the quartering of the Delegation and its office personnel, as well as the necessary office and meeting space.

A question which had to be weighed carefully before the delivery of the posts was their actual placement in the terrain in accordance with the provisions of the marking instructions on visibility from post to post, and on the marking of all the points where the boundary crossed roads or waterways. The terrain in the Norwegian marker sector from Trongsund to the mouth of the Jakobselv River is very rugged in certain places, and it was obvious that the sector would require the use of a great number of boundary markers. The shipment of the cut posts consequently, would have to take place according to a carefully organized transportation plan prepared on the basis of thorough map and terrain investigation.

During the Delegation's short inspection of the boundary area, there was

insufficient time to establish all the marker points in detail. During September 1946, however, a more careful inspection of the whole boundary line in the Second Boundary Sector was conducted by the man appointed to direct the Norwegian marking work; on the basis of this more detailed work plans were drawn up.

As previously mentioned, Section 6 in the Instructions on the boundary markers stated that the boundary posts were to be painted and the national coat of arms of the state concerned placed on them. The Norwegian coat of arms was prepared from a special drawing by the State Archives. As for the colors on the Norwegian boundary posts, the Ministry of Foreign Affairs decided, on advice from the Boundary Delegation and its experts, that the posts should be painted in one color, bright yellow, with a black top 10 centimeters high, since yellow and black were recommended as the color combination usually most visible in all types of terrain under changing weather and light conditions. The Soviet posts were to be painted in alternate, 10 centimeter wide bands of red and green.

In November 1946, the Ministry of Foreign Affairs appointed the members of the Norwegian Delegation to the Subcommissions on the basis of nominations by the Boundary Delegation. In the appointment of the delegation, it was carefully observed that each consisted of one member having special technical qualifications, one member having a thorough knowledge of the boundary sector concerned, and one Russian-speaking member.

Because of the various types of duties in the two Subcommissions, the secretary engaged for the First Subcommission was a lawyer, and the secretary for the Second Subcommission was an engineer. Those appointed were:

In the First Subcommission (in which Norway was to be the supervisory party): Department Chief Sverre Mosling, chairman; Astronomer in the Norwegian Geographic Survey, Niels Siro; and the Superior Court barrister, Egil Aamodt, secretary.

In the Second Subcommission (in which Norway was to be the performing

party): Professor of Geodesy, Dr Tor Eika, chairman; Engineer Harald Knudtzen; Engineer A. I. Torvik; and Engineer Anton Disch, secretary.

The corresponding Soviet subcommission was composed entirely of military personnel and consisted of officers primarily from the Corps of Engineers and from the border troops.

During the winter of 1946-47 the Boundary Delegation held general meetings, and settled, in collaborations with the Ministry of Foreign Affairs and the planning director in Finnmark, a number of questions of a practical-technical nature concerning the execution of the field work. Agreements were reached with owners of horses and boats in Sør-Varanger on transportation services during the boundary survey, workers were engaged, and the necessary instruments and materials were procured. Through the Ministry of Foreign Affairs the Defense Department was contacted for making 30 soldiers with the necessary officers available to help in the erection of the boundary markers and the clearing of the vistas, etc. Likewise, the Defense Department was requested to furnish the necessary automotive equipment, pack horses, and transportable small boats, as well as tents and bedding, etc., for the workers. The Defense Department promised to do so.

In the Joint Commission's Protocol No 1, Section II, 2 (cf. Section 9 in the Instructions on setting up boundary markers on the international Boundary), provision was made that each party was to manufacture and set up all the boundary markers in its own boundary sector, and the above-mentioned shipments of markers by the Norwegian Delegation were executed in regard to this.

In a note on 6 February, the Soviet Foreign Ministry, however, stated that the adopted protocol and instruction regulations should be understood to provide that each party manufacture and paint all the posts on its own side of the boundary; thus, all the posts on the Norwegian side of the boundary were to be finished by the Norwegians in both boundary sectors, while the posts on the Soviet side were to be manufactured and painted by the Soviets.

With regard to this, the Norwegian Delegation had to so alter its delivery orders for the marker posts that only half of the stipulated number of posts would be delivered to the northern sector, that is, those posts which were needed on the Norwegian side of the boundary, and, in like manner, also to deliver boundary markers to the Norwegian side of the southern sector. This change in transportation plan entailed numerous difficulties for the delegation's assistants in Finnmark, who had begun delivery under the previous transportation plan; delivery under the new plan, fortunately, could take place on the winter roads.

Recalculation to the same base of the two triangulation surveys of boundary areas under consideration (the Pasvikelv and Jakovselv triangulations) was carried out during the fall of 1946 by geodesists from the Norwegian Geographic Survey, and the recalculated coordinates were then sent over to the Soviet Delegation for conversion to the Pulkova system, of the Topographic-Geodetic Instructions, Section 1, point 2. The Norwegian Geographic Survey reproduced, in addition, the older boundary maps which, according to Article XI of the Subcommissions' Instructions, were to serve as an aid to the Subcommissions in the marking and re-measurement of the boundary areas.

During the winter of 1946-47, the Norwegian Delegation prepared its views on the further technical instructions which Moscow agreed the Joint Commission should discuss and adopt during the Commission meetings in March 1947.

9. Negotiations in Oslo in March 1947

During the negotiations in Moscow, the Norwegian Delegation had proposed that the Joint Commission's next meeting take place in Oslo, in accordance with usual international practice on the rotation of the seat of negotiations. No final decision on the next meeting place had, however, been reached in Moscow. Upon an official invitation from the Ministry of Foreign Affairs to the Soviet Foreign Ministry, it was later decided that the continued negotiations

by the Joint Commission would take place in Oslo in March 1947.

These negotiations took place from 12 to 28 March 1947. Representing the Norwegian side were all the appointed members of the Boundary Delegation; Representing the Soviet side were the chairman, Counselor of the Embassy I. V. Mayevskiy, and two other members, Colonel M. V. Petrunkin and Captain N. I. Pakhomov.

The negotiations dealt with the practical execution of the boundary survey -- (a) the technical aspects of the survey and, (b) the technical aspects of the marking.

(a) The Technical Aspects of the Survey

In the Topographic-Geodetic Instructions, Section 3, second paragraph, the following is provided:

"The delegations in the Joint Commission are to present to each other the original geodetic data for the area concerned, and all kinds of measurements, maps, and documents which can aid in the work."

After discussion at the meetings of the Joint Commission on 12 and 17 March, as well as at special conferences between the technical experts from both delegations, it was resolved that the exchange of topographic-geodetic material as mentioned in Section 3 of the Instructions was to be effected through the Norwegian Embassy in Moscow on 15 April 1947. In the Meeting Protocol No 10, Section IV, the maps and geodetic data which each party was to submit were more closely defined.

The main subject during the discussions of the Commission on the matter of the technical aspects of the survey was the precise instructions for establishing the boundary course in rivers and lakes. The Norwegian Delegation was of the opinion that the basis for the boundary marking adopted the agreement of 1826 and the maps from the Norwegian-Russian boundary survey in 1896 -- did not give the Subcommissions sufficiently precise directions for the establishment of the boundary line in waterways. It was therefore necessary, in the opinion of the Norwegian Delegation, that the Subcommissions be given further guidance in the form of more rigidly definitive principles. The

Delegation therefore presented for discussion a proposal for special instructions on the boundary course in rivers and lakes. The Soviet Delegation maintained, on the other hand, that the main principle for establishing the boundary course in waterways was indicated clearly enough in the Agreement of 1826, Article II, fourth and fifth paragraphs, and in the instructions adopted for the Subcommission's work and for the execution of the topographic-geodetic work. In case any doubts or lack of clarity were to arise during the actual boundary survey, it became the duty of the Mixed Commission in that even to settle such questions on the spot.

The result of the Commission's negotiations on this point was a compromise: no supplementary instructions on the boundary's course in rivers and lakes were adopted; but in the Commission's Meeting Protocol No 10, IV, were recorded instructions for the Subcommissions for the establishment of the boundary course in waterways which contained in four points essentially the same regulations as the original Norwegian draft of instructions. The protocolled directions read as follows:

- "1. Where the boundary follows the Pavikelv and Jakobselv Rivers, and where these do not form lakes, the boundary is to follow the river's greatest depth (thalweg), if nothing else is expressly agreed upon in the field work.
- "2. Where the boundary crosses a lake formed by the Pavikelv or Jakobselv Rivers, it must correspond to that in the map of 1896.
- "3. Where the boundary goes between islands, it must follow the greatest depth (thalweg), that is, in accordance with the same principle as for the rivers themselves. However, so far as possible, both parties should be ensured a navigation channel.
- "4. Where it is very difficult to determine the thalweg, especially in falls and rapids, the Subcommission is authorized to propose a practical solution which so far as possible, ensures both parties a reasonable channel."

During the experts' conferences, various technical definitions for the topographic-geodetic instructions, in addition to the above-mentioned questions questions were also discussed. On the advice of the experts, the Commission

approved certain changes in the instructions. (See Meeting Protocol No 14 and its attachment No 1 and 2).

b. The Technical Marking Work

The main provisions for the technical marking work were adopted in the instructions on the method of procedure for the erection of boundary markers. There was, however, need for a closer examination of certain provisions covering details in the instructions, for example, on the dimensions of stone cairns, on the method of procedure for the erection of marker posts on mountains, on the types of alignment markers, for the lake markers to be used when marking the terminal of the boundary in the sea, and reproduction and printing of the marking documents, etc. These matters, which were of an especially technical nature, were prepared in the experts' conferences, and the experts' recommendations were then brought before the Joint Commission for approval.

Full agreement on all points between the two delegations was reached on these matters (cf. meeting protocol No 10, 13, and 15).

In the note of 6 February 1947 from the Soviet Foreign Ministry it was declared that each party was obliged to produce the necessary boundary markers for its own side of the boundary. During the negotiations in March, the Soviet Delegation presented, however, a proposal that each party produce all the boundary markers for its sector of the boundary. This proposal was quite in accordance with the understanding which the Norwegian Delegation itself had of the previously adopted provisions, but upon the receipt of the note of 6 February 1947, the arrangements for the delivery of marker posts were changed so that the delivery of posts had now taken place only on the Norwegian side of the boundary, but along its entire extent.

The Norwegian Delegation therefore declared during the discussions in March, that the transportation of rough-dimensioned boundary posts in the trackless regions was technically very difficult, and that consequently it was quite unfortunate and expensive again to have to change the transportation plan. The Delegation observed, however, that it could be of advantage to turn

over the marking work for each sector as a whole to the respective Subdelegations, so that each party in its work sector had the full responsibility for all the technical marking work, in conforming with Section 9 of the Instructions.

The matter was thoroughly discussed both during the conference of the experts and in several Commission meetings, and as a result of this, the following final arrangements for the production and delivery of boundary markers for both sections were made (cf. meeting protocol No 10, IV).

The Norwegian Delegation was to procure and transport to the erection sites all the boundary posts for the Norwegian side of the boundary in the Second Boundary Sector. The Soviet Delegation, in the same manner, was to attend to all the posts for the Soviet side of the boundary in the First Boundary Sector. Those posts delivered by the Norwegians to the Norwegian side of the First Boundary Sector were to be compensated for by the Soviet by a corresponding number of posts in the Second Boundary Sector. The Norwegians were to procure 100 posts for the Soviet side of the boundary in the Second Boundary Sector while the other posts needed for the Soviet side in this sector were to be procured by the Soviets. The Soviets were, in addition, to procure the number of posts needed for the Norwegian side besides those delivered to this area by the Norwegians.

In connection with the discussions on the production and delivery of boundary posts, it was agreed that the posts procured by the Norwegian party did not need to be furnished with such braces at the base as are described in the Marker Instructions, Section 4, last paragraph, since the Norwegian Delegation, as opposed to the Soviet Delegation, was of the opinion that these braces would reduce rather than increase the stability of the posts because of the earth tremors (see footnote 4 to the Topographic-Geodetic Instructions).

A detailed draft of a schedule for the combined technical surveying and marking work was submitted by the Soviets during the negotiations. The draft gave an exact description of the type of work, and it laid down definite time limits for the conclusion of the various duties.

The draft was examined at several experts' conferences and was finally discussed and adopted at the meeting of the Joint Commission, held on 26 March 1947, in the form presented as appendix No 3 to the Meeting Protocol No 14. According to this plan, all the field work was to be completed by 30 August 1947.

c. Other Resolutions

The Commission next discussed a Soviet proposal on the "Instructions for the Arrangement for Boundary Trespassing for Personnel of the Joint Soviet-Norwegian Commission for Marking the International Boundary between the Soviet Union and Norway." After the inclusion of certain changes proposed by the Norwegian delegation, the draft was adopted in the form shown by the appendices to the Meeting Protocol No 12. At the same time, texts were adopted for the permits to be issued to persons authorized to cross the border in connection with the field work.

According to these instructions, the chairman of the Joint Commission, the members, secretaries, and interpreters could cross the boundary at any point in the Commission's territory, while the same persons in the Subcommissions, as well as the technical personnel of the Subcommissions, could cross the boundary only within the respective boundary sections of the Subcommissions. Laborers did not need special permits, but could, however, pass the boundary only when accompanied by their foreman, who had to have a permit for himself. For the more detailed regulations in the instructions, see appendices Nos 1, 2, and 3 to the Meeting Protocol No 12.

According to a proposal from the Soviets, the Commission also discussed and adopted "Instructions for the Joint Norwegian-Soviet Subcommissions on the Preparation of Marking Documents to be submitted to the Joint Commission". In Section 1, the Instructions divided the preparation of the marking documents in two main categories, the provisional preparation of the marking documents to be checked by the Joint Commission in the field, and the final preparation of the marking documents to be submitted to the Joint Commission for approval.

The Instructions are printed as an appendix to the Meeting Protocol No 11.

In the Joint Commission's Regulations Article I, on its mandate, it was established in Point 7 that a draft of "Instructions for the Continuous Inspection and Supervision of Boundary Markers and the Vistas on the Marked International Boundary" be prepared. During the negotiations in Oslo in March 1947, it was agreed unanimously that instead a formal agreement between Norway and the Soviet Union should be prepared on the same subject, since the permanent supervision which had to go into effect after the completion of the boundary marking should not be regulated by a set of instructions, but rather by a permanent treaty, approved by the governments of the two countries. This treaty was to include all of the so-called "boundary regimen" for the Norwegian-Soviet boundary, that is, it should also cover the rights of the two parties in the boundary waterways (traffic, fishing, lumber floatage, and water power).

The Soviet Delegation requested that a draft of such an agreement be submitted at a later date during the Commission's work. At the same time, the Soviet Delegation reported that it intended to prepare a draft for an agreement between Norway and the Soviet Union on the adjustment of possible conflicts and incidents on the common boundary. The Norwegian Delegation consented to consider such a draft of an agreement. (cf. Meeting Protocol No 9, II.) The Commission's Regulation was hereby altered to correspond with this. See Meeting Protocol No 13, III.

At the conclusion of the negotiations in Oslo, the Norwegian Delegation turned over several map sketches to the Soviet Delegation for the purpose of orienting them concerning the boundary's course in certain lake regions where certain problems might arise during the process^F of marking. It was specified that the sketches were intended only as study material to simplify the discussions which might come up for discussion during the actual boundary survey.

As the last point in the negotiations in Oslo the Commission resolved

that the actual boundary survey should commence on 1 June 1947, and be opened by an official Commission meeting that day at the headquarters of the Norwegian delegation, Skogfoss Tourist Station.

10. The Boundary Survey in the Summer of 1947

The Boundary Delegation arrived at its headquarters (Skogfoss) in the Pasvik valley on 30 May 1947. The surveyors and their assistants arrived at the boundary district some days in advance, and the geodists as early as 20 May, in order to begin the reconnaissance of the triangles on the Norwegian side of the boundary. During May the necessary mechanics and construction engineers had arrived and had been stationed along the border. They were held responsible for clearing everything for the commencement of the marking work on 1 June 1947.

As planned, the Joint Commission held its first meeting at the border on 1 June. The Soviet side submitted a written proposal for certain alterations and "Supplementary Technical Observations" in the Instructions on Topographic-geodetic work, and in the setting up of boundary markers. These technical observations were later discussed in conferences between the two delegations' experts on 3 and 5 June, and the results of this were submitted to the Joint Commission and approved in a meeting on 5 June 1947 (see appendix 3a and 3b to the Meeting Protocol No 17). Several of these new proposals offered technical improvements, but when they first came up during the actual field work, they often caused difficult practical problems for the Norwegian laborers since the plans of the foremen had to be changed to fit in with the new provisions. Because of the limited resources of the laborers and the special equipment which was at the disposal of the Norwegian party, the Delegation had to make wide preparations in advance in order to carry out the work accurately according to the adopted instructions.

In the meeting of 5 June, the Commission resolved, in addition, to alter the sector boundary between the First and Second Subcommissions' territories from 69 degrees 30 minutes north latitude to 69 degrees 32 minutes north latitude.

This consisted of a shift of approximately 1.7 kilometers northward of the demarcation between the two sectors, and consequently a corresponding reduction of that area in which the Norwegian party had the responsibility for the performance of the field work.

After the results were prepared and signed by the chairman of the Joint Commission in accordance with the Instructions on Boundary Trespassing, Sections 2 and 3, the field work in the Norwegian sector began on 6 June and in the Soviet sector on 8 June.

WORK IN THE DESIGNATED BOUNDARY SECTOR

The Marking Work

At the opening of the field work in the Norwegian work sector, the two delegations in the second communication undertook a common reconnaissance of the boundary extending from the sector division south of Eldfjord in the Pasvikelv River (49 degrees, 22 minutes), north along the river and around the Berle Glob valley. During this reconnaissance, a record was made of the number and placement in the terrain of all markers found in accordance with the placement plan which had been worked out in advance by the Joint Commission over the whole area from the division of the sectors to the south of the Gams-Jakobselv.

As soon as the reconnaissance was completed, the marking work was begun. Prior to the marker posts being set or blasted, the posts were transported from their positions along the boundary to their destination and there set up. The posts were raised just as provided in the marking instructions, but instead of staves at the base of the posts, a solid stone lining was packed into the slit to prevent later earth tremors from displacing the posts. In addition, all the posts in the Norwegian section were dug 2 meters into the earth whereas the marking instructions only prescribed 1 to 2 meters' depth. A large number of marker posts were also raised on bare rock, and bolted thereto.

To make the work as efficient as possible, such overtime work was put in as necessary transportation to and from the place of work took a long time in the partially trackless areas where the work took place. Where conditions of

transportation made it practical, the work shifts were employed.

Clearing the forest and cutting the side lines, etc., was accomplished partly by military crews (30 men) and partly by laborers hired in connection with the marking of boundary markers.

East of Pasvik the marking work was divided as follows: one group of workers marked the stretch between Russefjell Mountain and Vardfjell Mountain, and a second group marked the boundary from Vardfjell Mountain to Tardangeren. After the first group had completed its work, it was sent further east to mark the boundary on the stretch from Korsefjell Mountain to Lomfjella in the Grasse Jakobselv Valley, at the same time as the marking work was begun by a third group on the stretch from the mouth of the Grasse Jakobselv River south to Langelvassvatn. Finally, those workers who had done the marking in the Pasvik Valley began marking the neighboring stretch from Tardangeren to Korsefjell Mountain.

In regard to the marking around Sordisvatn, the Soviet Party found that more marker posts would have to be set up in order to fulfill the demands of the instructions on visibility from one post to the next. After an examination on 7 July by the representatives of the Joint Commission, agreement was reached on the setting up of certain supplementary posts (see Section Protocol No. 24, 11b). This supplementary work was done immediately after the examination so that the marking of the land boundary in the Norwegian boundary section was thereby completed before the end of the time limit on the schedule, 20 July 1947.

The workers from the boundary districts to either side of the labor from the south, were dismissed on 20 July, while the rest of the workers were kept for marking the entrance to the mouth of the Grasse Jakobselv River which was not yet finally established by the Joint Commission. (See below under point d, in this section.) Since, however, the settlement of this question dragged out, the rest of the workers, with the exception of a supervisor and 5 workers, were dismissed on 1 August. The alignment markers in the mouth of the Grasse Jakobselv could be set up only at the end of August.

In connection with the marking work in Pasvik, a boundary pole was set up on the Norwegian side of the boundary across the road at Storvass where the

oral contact between the Norwegian and Soviet authorities takes place. The gate is painted the same colors as the boundary posts (yellow and black) and is identified by the Norwegian national coat-of-arms.

In the summer of 1946 there will, in addition, be set up Norwegian national coast-to-coast (signal points) on the individual Norwegian islets in the Pasvik waterway and presumably also in the Gironse Jakobselv River where the course of the boundary does not directly follow the placement of the posts. This is surely a Norwegian enterprise.

It can be further stated that the Norwegians have decided to investigate the possibility of planting marsh grass on the Norwegian headland at the mouth of the Jakobselv. The marsh grass would bind the sand and thereby prevent the river from changing its course. It would at the same time make a firmer foundation for the alignment markers.

The Surveying Work

The technical surveying personnel consisted of 2 geodetic parties, 6 polygon surveying parties, one hydrographic party, as well as one topographic party for the carrying out of measurements in the river. Each surveying party consisted of 1 surveyor and 2 assistants.

The geodetic parties began on 7 May to work under the points for the triangulation and to set up trigonometric signals. The triangulation was completed approximately 20 June and the coordinates of the trigonometric points in the accepted axis system (Pulkovo) were then calculated for each. At the same time the polygon surveying parties had, partly by triangulation and partly by polygon surveying, determined the exact placement in the terrain of the boundary markers and had calculated the coordinates for these. All the geodetic data was reported to the topographers as soon as it became available; the topographers drew on the boundary maps by detailed measurement on the basis of the fixed points.

The maps were pencil-drawn in the field and then drawn in clean copy at the topographers' headquarters. During the field work the Soviets requested an entirely new delimitation of the map sheets than that adopted in August 1946 and

more closely defined in March 1947 in the appendix 2 to the Meeting Protocol No 14. The new proposal was concerned with making a completely new boundary map to be divided into 18 map sheets, 2 for each Subcommission's work section, each map sheet bounded by meridians and parallels with 1 minute's distance between the bounding meridians and 5 minutes' distance between the bounding parallels. The proposals presented the obvious advantage that the map sheets could thereby be placed together consecutively, and be easier and more lucid to study together. However, all the Norwegian plane tables had had to be constructed in advance for the boundary survey according to the system which had previously been discussed and adopted, and the proposals therefore made it necessary for all the Norwegian original maps to be sent to Oslo as they were completed for remounting by special reports at the Norwegian Geographical Survey. This remounting was tedious work: from all the original maps, photostats had to be made, which were then cut and clipped together according to the new delineations and then rephotographed again; these photographs thus formed the basic drawings for an entirely new reproduction.

Due to an sickness among the topographers during the work in the last three sections, which were in a somewhat difficult to survey, an extra topographer had to be called from Oslo. The technical surveying was thus successfully completed within the time limits which had been set by the Joint Commission.

The Field work in the First Boundary Sector

In the First Boundary Sector, where the field work was to be done by the Soviet party, the work was done somewhat differently than in the second Subcommission's area. While, for example, the marker posts in the Norwegian boundary sector were ready, cut by the saw mill during the winter of 1946-47, the posts in the first Sector were partly cut in the woods, and partly taken from timber in Pasvikelv and cut down to size during the actual execution of the marking work.

for the sake of the technical surveying work, the Soviet party divided its work team into 11 sub-sections. In each of these sections the technical surveying work was performed by one topographer with assistants. While the work in the Norwegian sector was divided among different specialists, the Soviet surveyor carried out all the technical surveying operations within his sub-section -- triangulation, polygonal measuring, detail surveying, and charting. Such a method of work demanded, however, a large labor force that the Norwegian delegation had at its disposal.

The Norwegian members of the Joint Commission checked daily the technical marking and surveying work in the field which the Soviet party carried out. The subcommission acted in each reconnaissance of the entire sector from Krokfjell Mountain to Måltarnes, and determined at which points in the terrain the boundary markers were to be placed. The topographic and geodetic work was likewise constantly supervised in the field by the subcommission's two Norwegian technical surveying experts.

The Mixed Commission's Checkin and Approval of the Work of the Subcommission

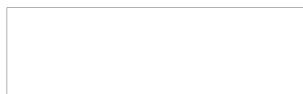
The agreed schedule (Appendix 1 to the Meeting Protocol No. 14) had figured 15 August as the deadline for the submission of the collected results of the subcommission. Because of the various formalities with the Norwegians, the work did not actually begin until approximately two weeks later than counted on and, in addition, the subcommissions had had various other hindrances so that the deadline of 15 August could not be maintained. The tempo of work was increased, however, as long as it was possible, and by the close of August both Subcommissions were able to submit the prescribed original documents from the boundary survey for the check and approval of the Joint Commission. (The subcommissions had, moreover, regularly sent in their official meeting protocols and work reports -- cf. Instructions for the Subcommissions, Article VII. Each of the Subcommissions submitted 12 protocols and 5 reports. One set of these original documents, in Norwegian and Russian texts, signed and stamped by both parties, is deposited in the archives of the Ministry of Foreign Affairs.)

This last was a footnote which was misplaced and misnumbered in the foreign text.⁷

CONFIDENTIAL

C I A

FOREIGN DOCUMENTS DIVISION



17 Oct 1951
SECRET

50X1-HUM

Bulgarian Enterprises

Ministries of Industry
and Mines, Sofia

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

PEOPLE'S REPUBLIC BULGARIA

MINISTRY OF INDUSTRY

SOFIA,

Boulevard Aleksandur Stamboliyski 2

CONFIDENTIAL

MINISTRY OF MINES
AND
MINERAL WEALTH

SOFIA,

Ulitsa Graf Ignatiev No 10

CONFIDENTIAL

CONFIDENTIAL

State Mining Combine,
SALT MINES, NON-METALLIC MINERALS AND QUARRIES
SOFIA, Graf Ignatiev 10

PRODUCES:

Quartz Sand, Kaolin, Salt.

State Mining Combine,
SOLNITSAI, NEUDNI ISKOPAEI ISKOPAEI I KARIERI
SOFIA, Ulitsa Graf Ignatiev 10;

State Mining Enterprise,
KAOLINOVIMINI
Railroad Station SENOVO, RAZGRADSKO;
and

State Mining Enterprise,
KAOLINOVIMINI
Railroad Station BOZHIDAR, NOVOPAZARSKO

PRODUCE:

1. Raw Kaolin,
2. Washed Kaolin,
3. Quartz Sand, with Dimensions:
 - from 0.1 - 0.2 millimeters,
 - from 0.2 - 0.4 millimeters,
 - from 0.4 - 0.6 millimeters,
 - from 0.6 - 0.8 millimeters,
 - from 0.8 - 1.0 millimeters.

CONFIDENTIAL

State Mining and Salt Enterprises,
CHERNOMORSKI SOLNITSKI
in BURGAS

PRODUCES: ~~Crystal Salt~~, ~~Ground Salt~~, Refined Salt, Briquettes.

State Mining and Salt Enterprise,
SOLOPODEM
Railroad Station MIROVO, PROV. BURGAS

PRODUCES:
Granulated-Crystal Salt, Ground Salt, Refined Salt,
Industrial Salt.

All Orders for Planned Deliveries of Kaolins and Quartz Sand should be
Addressed to:

Central Office of the State Mining Combine,
SOLNITSKI, NERUDNI IZKOPAEMI I KARIERI;

The Planned Orders are Filled by:

RESPECTIVE KAOLIN-PRODUCING ENTERPRISES
at Railroad Station MIROVO and Railroad Stations
BOZHIDAR.

All Orders for the different Kinds of Salts should Pass Through:
The CENTRAL COOPERATIVE UNION and KOLSTOK
in SOFIA.

(Money Orders should Go Through the Management of the RESPECTIVE
ENTERPRISES.)

CONFIDENTIAL

State Mining Combine,
 SOLNITSI, NERUDNI ISKOPEMI I KARIERI
 SOFIA, Ulitsa Graf Ignatiev 10;

State Mining Enterprise,
 KARIERI NERUDNI ISKOPEMI
 SOFIA, Ulitsa Graf Ignatiev 10

PRODUCE:

Plaster, Baryte, Fluorite, Feldspar, Diatomaceous
 Earth, ~~Fire~~-Clay, Plastic-Clay, Ochre, Chalk (Chalk
 Rock), Asbestos (~~Raw~~ and ~~Ground~~ for Insulation), Mica-
 (~~Raw~~, ~~Ground~~ and in ~~Polts~~), Magnesite, Smelting-Clay,
 Refractory-~~Clay~~, Talc (~~Raw~~ and in ~~Fine Powder~~ (Grounded)),
 White Marble for Mosics, Black Stone for Mosics, Quarry-
 Stone, Limonite, Filtering-Powder, Hermatite, Magnetic
 Sand, Kaolin, Quartz Sand.

All Orders for Planned Deliveries of the Above should be Addressed to:

Central Office of the State Mining Combine,
 SOLNITSI NERUDNI ISKOPEMI I KARIERI;

The Planned Orders are Filled by the:

Central Office of the State Mining Enterprise,
 KARIERI I NERUDNI ISKOPEMI.

(Money Orders sent to the BULGARIAN NATIONAL BANK 6,
 DONDUKOV Branch.)

CONFIDENTIAL

(Ministry of Mines and Mineral Wealth),
 State Mining Combine,
 VUGLISHTA
 SOFIA, Ulitsa Graf Ignatiev 10

PRODUCES:

Black Coal, Brown Coal, Lignite Coal, Anthracite
 Coal, Fine Washed Coal, Ammonia Water, Karbolineum
 Derivatives, Naphthalene, Turpentine, Briquettes,
 Resins, Coke, etc.

(For Information:

State Mining Combine,
 VUGLISHTA
 SOFIA, Ulitsa Graf Ignatiev 10.)

(Ministry of Mines and Mineral Wealth),
 State Mining Enterprise,
 MINI PERNIK
 DIMITROVO (Pernik)

PRODUCES:

Coal for Industry, Transportation and Heating Purposes.

(FREE MARKET SALE: Only of Inferior Quality Coal, Mined from
 Open Pits. A Grade Called PLYAKA, Used for Baking Bricks -
 500 Levas the Ton.)

THE MANAGEMENT OF THE MINES has openings for:

Mining and Machine Technicians, Coal-Miners and Common Laborers
 for the Underground and Open Pits.

IMMEDIATE EMPLOYMENT

(1) The working conditions for mining and machine technicians are as follows: Salaries according to pay classification charts with corresponding bonuses for highly qualified work, overtime and underground pay with premiums for over production.

(2) The conditions of employment for miners and common laborers are as follows: Wages according to the wage-table for miners are from 330 to 560 levas per day with premiums for over production. The wages for production over the quotas for the miners run from 800 to 1,500 per day and in rare cases above 1,700 levas per day. All miners receive increased rations: bread (1,260 kilograms a day for the underground miners and 1,050 kilograms a day for those who work on the open pits); sugar (1 kilogram); ~~olive~~ (1 kilogram). The regular pit workers receive additional increased rations of foodstuffs; such as, fats, sugar, soap, etc.

All workers receive working clothes and ~~personal~~ sandals. The other ~~retained~~ products are distributed very regularly. Nutritious and inexpensive food is served in workers' cafeterias. Living quarters with heating and lighting are provided for bachelors in the barracks (communal living quarters).

FOR EMPLOYMENT THE CANDIDATE IS MERELY REQUIRED TO PRESENT HIS IDENTIFICATION CARD.

From the

MANAGEMENT OF THE MINES.

CONFIDENTIAL

(Ministry of Mines and Mineral Wealth),

State Mining Combine,

RUDI I METALURGIYA

SOFIA, Ulitsa Graf Ignatiev 10

PRODUCES FROM ITS ORE MINES, ~~AND IN ITS ENRICHMENT-PROCESSING~~
PLANTS, AND METALLURGIC ~~WORKS-PROCESSSES~~ THE FOLLOWING ORES,
CONCENTRATES, AND METALS:

ORES - Pyrites, Lead-Zinc Con-
centrates, Copper, Gold,
Iron, Manganese;

CONCENTRATES - Copper Concentrate,
Lead Concentrate,
Zinc Concentrate;

METALS - Lead, Copper, Gold, Iron.

State Mining and Metal-Bearing Enterprise,

The ELISEYNA PLANT

PRODUCES:

ORES - Copper, Lead, Zinc, Copper-Lead,

~~etc.~~

CONCENTRATES - Copper, Lead, Zinc,
Copper-Lead, etc;

Copper Sulphate

Black Copper.

(For Information:

State Mining Combine,

RUDI I METALURGIYA

SOFIA, Ulitsa Graf Ignatiev No 10.)

CONFIDENTIAL

State Mining Enterprise,
MINA NIKOLAEVO

PRODUCES:

Good Quality Brown Coal for Heating, for Thermal
~~Electric~~ Power Stations, for Industrial and Brick-
Producing Purposes.

ALWAYS PREFER THE COAL OF MINE "NIKOLAEVO", WHICH HAS EXCELLENT
THERMAL VALUE AND THE LOWEST MOISTURE CONTENT COMPARED TO ALL
OTHER BROWN COAL

COOPERATIVES

The "Trud" (~~Trud~~ ^{Teil}) Wagon and Hardware Cooperative in Vrabovo, Troyan Okoliya,
ordinary
~~wooden~~ wagons and tin products.
The "Radio" ~~Apparatus~~ ^{Machine} Cooperative in Sofia: radiators and all types of
heavy construction machines.

The "Dimitur Blagoev" Brush Cooperative in Sofia: brush products

The "Narodna Mebel" (National Furniture) Tapestry and Furniture Cooperative
in Sofia: household furniture, studio couches, and various furniture items.

The "Zidar" (~~The~~ Mason) Furniture Manufacturing Cooperative in Sofia:
carpentry and furniture.

The "Bratski Trud" (Brotherly Toil) Furniture Cooperative in Stara Zagora:
furniture and carpentry.

The "Edinstvo" (Unity) Furniture Cooperative in Gabrovo: furniture,
carpentry, barrel manufacture, painting, heels for shoes, turning.

The "Hr. Botev" Furniture Cooperative in Kirilovo, Stara Zagora Okoliya:
fanners, bee-hives, and carpentry.

The "9 Septemvri" (9 September) Shoe Cooperative in Sofia: all types of
footwear, and leatherware (purses and bags).

The "Georgi Dimitrov" Shoe Cooperative in Sofia: all types of footwear and
leatherware.

The "Pobeda" (Victory) Shoe Cooperative in Plovdiv: all types of footwear
and leatherware.

The "Troika" Shoe Cooperative in Vidin: all types of footwear and leatherware.

The "Obedinenie" (Association) R Shoe Cooperative in Varna (now Stalin):
all types of footwear and leather ware.

The "Osvobozhdenie" (Liberation) Shoe Cooperative in Burgas: all types of
footwear and leatherware.

The "Zdravokhod" Shoe Cooperative in Gabrovo: all types of footwear and
leatherware.

The "1 May" Shoe Cooperative in Dobrich: all types of shoes and sandals.

The "Mlada Republika" (Young Republic) Shoe Cooperative in Sofia: all types
of shoes and slippers.

The "Petoluchka" Saddle-making Cooperative in Vratsa: knapsacks, satchels,

CONFIDENTIAL

CONFIDENTIAL

and ammunition.

The "Kozhiadel" (Hide-Processing) Trunk and Leatherware Cooperative in
Sofia: trunks, knapsacks, and satchels.

The "Obedinenie" (Association) Footwear and Saddle-making Cooperative in
Sofia: Ammunition, knapsacks, and balls.

The "Kooptrud" (Cooperative Toil) Trunk and Leatherware Cooperative in
Sofia: trunks, knapsacks, and satchels.

CONFIDENTIAL

METALWORKING

State Industrial Combine,
Ministry of Industry,
Boulevard Khristye Botev 57, Sofia

This unit combines and manages the enterprises producing the following items:

Bolts, nuts, rivets.

Wires and Wire Products: Nails, nets, tacks and chains.

Picks, axes, hammers, adzes, mattocks, axles for carts, spades and pickaxes.

Horseshoes and Spikes: for oxen and horses.

Aluminum and enameled containers. Spoons, forks, and knives.

Zinc-galvanized pails.

Milk cans.

Beds, bed springs, perambulators.

Stoves for heating and cooking.

Cast iron sewer pipes and fixtures.

Cast iron enameled wash basins, toilets, and water tanks.

Cast iron parts for stoves, shanks, grates, etc.

Water and steam fixtures: taps, faucets, valves, batteries, etc.

Clasps, metal plates, and caspules.

Iron constructions for bridges, stairs, roofs, etc.

Fire-resistant safes, iron cabinets, filing cabinets.

Various forged products: hinges, door knobs, latches, etc.

Extruded products: metal barrels, canning cans, cans for paints, for lacquer, etc.

CONFIDENTIAL

National jewelry.

Lead products: pipes, BB's (pellets), seals.

Medical and dental chairs, cabinets, etc.

Water pipes.

Fiacres, cabriolets and carriages.

Iron wheelbarrows - for use ~~in the~~ labor brigades.

Balances, precision scales, ~~grams~~ and ~~other~~ weights, ~~phonoscopes~~.

Gramophones, gramophone parts, and records.

Bakelite and metal products.

State Industrial Enterprise,

TURMUS; For Metalworking at

PLOVDIV, Ulitsa Illarion Makariopolski 18.

State Industrial Enterprise,

ZHITI

KUSE,

MANUFACTURES:

Iron Section - All kinds of bolts, rivets, nuts, nails, wires, high-tension cables, wire rope, wire nets for fences of all dimensions, high and low-tension hinges.

Chemical Section - Manufacture of ~~lead~~ enamel, ~~red lead~~ (manganese) and zinc oxide, ~~etc.~~

State Industrial Enterprise,
METALURGIIYA
GORNA ORYAKHOVITSA

MANUFACTURES:

Section No 1 - Spraying apparatus (portable and on wheels) for vineyards and orchards, and spare parts for same.

Section No 2 - Heating and cooking stoves and different castiron moldings.

STATE TOOL PLANT,
Village of Bichkinya, GABROVO

MANUFACTURES:

Files, Precision instruments, agricultural machines - and has a steel-forging shop.

State Industrial Enterprise,
METALNA INDUSTRIYA
SOFIA

MANUFACTURES:

Extruded products, all kinds of furniture handles, locks, metal heel plates, shoeshine boxes, facial cream boxes, metal tacks, equipment for city lighting, etc.

Also MANUFACTURES:

Medical Equipment - Dental chairs (large model), dental cuspidors, laryngologist swivel chairs, gynecological tables, medical swivel stools, medical instrument cabinets, tables, medicine cabinets, shelves, operation tables and desks.

Barbers' Chairs - (large model), shelves, etc.

All kinds of metal accessories for travelling bags and bags.

STATE METAL-PACKAGING FACTORY

PLOVDIV,

Ulitsa "Dr. P. Stoyanov" No 1

MANUFACTURES:

All kinds of lead pipes and metal foil packaging products.

State Industrial Enterprise,

VERIGA,

BURGAS

MANUFACTURES ALL KINDS AND IN ALL DIMENSIONS:

Nails ~~wire~~ ~~iron~~, forged, galvanized with copper, galvanized with zinc and barbed)

Copper wire and ~~ropes~~;

Spades, small spades, pincers, large spades;

Horseshoes for oxen, mules and horses (Russian type);

Sewer pipes, pipes, spare parts for stoves, etc.

State Industrial Enterprise,

MADARA

PLOVDIV,

Ulitsa Sergey Rumyantsev No 10

MANUFACTURES:

Iron beds, iron fire-resisting safes and cabinets,
perambulators, and wheelbarrows for use in the
Labor Brigades.

STATE BUTTONS FACTORY,

GABROVO

MANUFACTURES:

Bakelite products and all kinds of buttons of
bakelite, bone, mother-of-pearl, galalite,
ambrasite, palapaste, etc.

STATE BED FACTORY, NADEZHDA

STARA-ZAGORA

MANUFACTURES:

All kinds of iron beds with springs - tin-faced,
pipe-like construction, semi-tin-faced

Hospital beds, Children's beds, etc.

State Industrial Enterprise,

FIRST BULGARIAN FACTORY, for metal buttons, at

VARNA

CONFIDENTIAL

CONFIDENTIAL

MANUFACTURES:

All kinds of bakelite buttons and different kinds
of bakelite products;
Metal buttons and different kinds of small metal
products;
Different aluminum and zinc containers.

Ministry of Industry,
State Industrial Enterprise,
Machine Building, MASHINOSTROENIE
SOFIA,

Ulitsa Laga 10

COMBINES AND MANAGES ENTERPRISES WHICH MANUFACTURE THE FOLLOWING
TYPES OF MACHINES:

For agriculture, for making instruments, for
the textile industry, for the ceramics in-
dustry, for the canning industry, for the
seed-oil industry, for the food industry,
for the milling industry, for the rubber
industry, etc.

State Machine-Building Plant,
ANTON IVANOV
PLOVDIV

MANUFACTURES:

M. K. 100
~~Machines for manufacturing tools.~~

State Machine-Building Plant,
 Chervena Zvezda
 Railroad Station DebeleTS
 Veltko-Turnoversko

MANUFACTURES THE FOLLOWING KINDS OF MACHINES:

Concrete-Mixers - Model Z.Ch.Z. - 360, with high capacity, with easy and automatic servicing. Power consumption economy of 20 percent, in comparison with the ordinary. The machine is solidly constructed and can be easily moved.

Elevators - Model 314, Venge, with planet gear. Transmission ratio 1:4. Solid and good construction. Easy, automatic control. Usual weight for vertical lifting up to 500 kilograms.

ALSO, MANUFACTURES ALL MACHINES FOR THE MODERN CERAMICS INDUSTRY,

SUCH AS:

Keller's automatic elevators for lifting; Keller's automatic elevators for lowering; ~~underground Keller's elevators~~; Keller's automatic multi-tracked wagons, rotating wagon-platforms, and wagon platforms with rails.

Quick and easy servicing. Guarantee of security. Economies in power consumption. Iron chassis construction. Handy to mount and dismount.

Pistol Presses For Tiles: New model. Solid construction. Large production capacity. Fifteen shots a minute. Convenient servicing.

Other manufactured items ~~are~~ ^{include} dumping rotating wagons and wagons for dry and moist tiles, ~~and~~ ^{and} all sorts of iron frames, ~~as well as~~ ^{and} all sorts of hydraulic presses for different purposes.

CONFIDENTIAL

State Plant for the Manufacture of Refrigerators,
KHLADSTROY
SOFIA

MANUFACTURES AND DISTRIBUTES:

All kinds and sizes of electric refrigerators, electric-cooling chambers, electric-cooling show-windows, installations for cooling liquors, machines for producing ice-cream and deep-freezers.

ALSO, MANUFACTURES:

Electric-cooling generators from 250 to 4,000 kilowatts per hour, cooling elements and combined coolers for pasteurizing milk.

Boiler-Building Plant,
GEORGI KIRKOV
SOFIA

BUILDS:

Water-tube and fire-tube boilers for industrial and heating purposes, autoclaves, cisterns and reservoirs.

Machine-Building Plant,
GEORGI DIMITROV
RUSE

MANUFACTURES:

Special-Agricultural machines for seeding;

Installations for flax and hemp machines.

CONFIDENTIAL

CONFIDENTIAL

State Machine-Building Plant,

OnERNO MORE

VARNA

MANUFACTURES:

Pneumatic hammers, Spring-action hammers, Ex-centric presses, Friction presses, Gas-generators installations, Water-pipe systems, Gate valves.

State Machine-Building Plant,

SILA

YAMBOL

MANUFACTURES:

Building materials, Ceramics machines, Iron constructions.

Machine-Building Factory,

STHUG

NOVA-ZAGORA

MANUFACTURES:

Machines for mills, Installations, ¹⁴⁻¹²Repairing all kinds of repair work.

State Machine-Building Plant,

SPARTAK

BURGAS

CONFIDENTIAL

CONFIDENTIAL

MANUFACTURES:

Auger presses, Steam boilers, Slaughter-house equipment, Centrifugal pumps, Ventilators, etc.

State Machine-Building Plant,

POBEDA

SLIVEN

MANUFACTURES FOR INDUSTRIAL FULLERIES:

Carding textile machines (the newest models), Washing machines, Gages and combs for weaving machines for heavy woolen materials, Cotton and wool presses, Baskets for automatic supply and apparatus for continuous threading, Funnels for preliminary winding on circular machines, Carding machines, Textile machines for wool, cotton, etc., and Spare parts.

State Industrial Enterprise,

KIRO KONAREV

Railroad Station GORNA-ORYAKHOVITSA

Village of KALTINETTS

MANUFACTURES:

Diesel and gas motors, Centrifugal pumps, All kinds of gear wheels, Sockets, etc.; Fundamental repairs of brick and tile machines. Making of dies and forms. Fundamental repairs of gas generator, mills, machines for pressing seeds for oil and other kinds of machine parts.

CONFIDENTIAL

CONFIDENTIAL

State Machine-Repair Factory,
TRYAVNA

MANUFACTURES AND REPAIRS:

Machines, Machine parts and Agri-

cultural machines.

State Machine-Building Plant,
PROGRESS
STARA-ZAGORA

MANUFACTURES:

All types of machines for the canning industry,
Machines for the bakery combines, Machines for distilleries, Shoe
~~and other machines, etc.~~

State Industrial Combine,
Ministry of Industry,
VULNENA INDUSTRIYA
SOFIA,

Ulitsa Gavril Genov No 19

COORDINATES AND MANAGES ALL STATE ENTERPRISES WHICH MANUFACTURE

THE FOLLOWING:

1. ~~Cotton and woolen cloth,~~
2. Rugs; Persian-type, national embroideries, etc;
3. ~~Wool~~-yarns for weaving, machine-knitting and hand-knitting;
4. ~~Ready-made~~ knitted goods;
5. Felt hats; ~~Boilers~~, caps, uniform-caps, etc;
6. Felts and ~~boilers~~, especially for industrial uses.

CONFIDENTIAL

CONFIDENTIAL

It exhibits characteristic and diversified products of the Home Textile Industry on a special stand at the International Sample Fair in Plovdiv. Visit the stand of the State Industrial Combine.

VILNENA-INDUSTRIYA:

State Wool-Textile Combine,
KUNO, Railroad Station ISKUR

MANUFACTURES:

All kinds of woollen cloth.

State Textile Combine,
GEORGI DIMITROV
SLIVEN

MANUFACTURES:

Cotton and woollen cloth, Popular and luxury blankets,
and All kinds of woollen yarn.

State Weaving Factory,
NARODNA REPUBLIKA
GABROVO

MANUFACTURES:

High-grade fleecy woollen yarn.

State Industrial Enterprise,
USPEKH
GABROVO

MANUFACTURES:

Pure woollen cloth, Blankets and Yarn.

CONFIDENTIAL

CONFIDENTIAL

State Textile Factory,
GEORGI GENEV
GABROVO,

MANUFACTURES:

Woolen yarn, cloth, and blankets.

State Industrial Enterprise, former
IVAN K. BEROV
GABROVO

MANUFACTURES:

Woolen cloth and yarn.

State ~~Wool-Weaving~~ Factory,
OREL
GABROVO

MANUFACTURES:

All types of ~~fleece~~ ^{wool} yarn from local and imported
wool.

State Industrial Enterprise,
IVAN LYUTSKANOV
Village of BICHKIYA, ~~GABROVO~~

MANUFACTURES:

Woolen knitted goods.

CONFIDENTIAL

CONFIDENTIAL

State Wool-Textile Enterprise,
SPAS GEORGIEV
SLIVEN

FACTORY:

For all kinds of woollen cloth and blankets.

State Factory for Reconditioned Wool,
INTURO
SLIVEN

MANUFACTURES:

All kinds of reconditioned wool and felts.

State Textile Factory,
I MAY
SLIVEN

MANUFACTURES:

Modern woollen cloth and blankets.

State Factory,
PASMANTERIYNA INDUSTRIYA
SOFIA,

Ulitza Kiril i Metodi 42

MASS PRODUCTION OF HIGH GRADE DRY-GOODS (Narrow Weaving):

Taffeta

ribbons, silk and semi-silk ribbons for hats, elastic bands for
garters, military, school and decorations ribbons, ladies' straps,
swaddling bands, buckram, belting, tri-color ribbons, national
custom embroideries, etc.

CONFIDENTIAL

~~CONFIDENTIAL~~

MASS PRODUCTION OF ACCESSORIES FOR OTHER INDUSTRIES:

All kinds

of shoe bands and laces, rubber, clothing, leather, millinery, and ~~similarly~~ for the electrical industry (bands for electro-motors, ~~etc.~~), printing and book-binding bands, ~~etc.~~. All kinds of bandages and gauze up to a 10-centimeter width for medical purposes, wick for lamps (all dimensions).

(All the State Industrial and Commercial Enterprises and Offices should plan and order as early as possible those ~~dry-goods~~ which they need for their future seasonal production and other purposes.)

State Dry-Goods Factory,
ZMECHKA KARAMEFILOVA
VARNA

MANUFACTURES:

Fishing nets, gauze bandages, ~~waving~~ band, silk ribbons, different bands, lamp-wick, shoes-laces, ~~etc.~~

State Industrial Enterprise,
'FILTIS'
VELIKO-TURNOVO

MANUFACTURE:

Raw Silk

State Industrial Enterprise,
'SV. GEORGI'
TRYAVNA

MANUFACTURES:

Woolen cloth and blankets.

CONFIDENTIAL

State Enterprise,

MINCHO TOPALOV

(Formerly - SHAPKARSKA INDUSTRIYA)

RUSE

MANUFACTURES:

Cloth, felt, straw and cotton hats, berets and
fezes. Special section for hat bodies.

State Textile ~~Factory~~,¹⁹⁷⁷

5 DEKEMVRI / 5 50 - 3 - 1

SLIVEN

MANUFACTURES:

Popular and jacquard blankets.

State Industrial Combine,

Ministry of Industry,

PAMUCHNI PREDACHNITOI

SOFIA,

Boulevard Tsar Osvoboditel No 5

COORDINATES AND MANAGES THE ENTERPRISES WHICH MANUFACTURE:

Cotton
yarn (single-ply and multi-ply), sewing thread and weaving thread, ~~Vanguard~~^{VICUNA}
yarn.

CONFIDENTIAL

CONFIDENTIAL

State Weaving Factory,

TUNDZHA

YAMBOL

MANUFACTURES:

High grade cotton cloth - Shirting, oxfords, flannels, percale and cheese cloth, gobelin, and terry velvet.

State ~~Millinery~~ Factory,

ANDREY YURUKOV

HIGH QUALITY PRODUCTION OF DIFFERENT ~~WELL-FITTED~~ KINDS OF HATS:

Caps,

Uniform caps, college caps, caps without a visor, berets, Stalin caps, skiing caps, summer straw hats, hats of wood-shavings, etc.

Since the nationalization of industry has been achieved, production has been increasing daily and the quality of the products has reached an ~~enormous~~ level thanks to the efforts of management and to great enthusiasm of the workers. Of the individual ~~milliners~~ 90 percent have joined the factory.

Large-scale production of hats from wood-shavings has been possible. Having the know-how, ~~we are~~ no longer dependent on the foreign market as in the past.

State Knitted-Goods Factory,

KRUSTYU DOBREV

STARA-ZAGORA

MANUFACTURES:

All kinds of high-grade cotton knitted-goods.

CONFIDENTIAL

CONFIDENTIAL

State Cotton-Spinning Factory,

9 SEPTEMBER

PLOVDIV

MANUFACTURES:

High-grade industrial yarn and knitting and
sewing thread.

State Cotton-Goods Factory,

BALKAN

TRYAVNA

MANUFACTURES:

High-quality cotton products.

State Factory for Sewing-Thread,

BULGARIYA

KAZANLUK

MANUFACTURES:

First Quality sewing thread and thread for
embroidering.

(SIUNTSE, PAYAK, ROZA) (Lun, 4, 10, 100)

State Textile Factory,

SINITE KAMUNI

SLIVEN

MANUFACTURES:

High-grade cotton yarn and cloth fabrics

State Cotton-Spinning Factory,

"PLOVDIVSKA PREZHDA"

CONFIDENTIAL

(PLOVDIV SPINNING)

- 19 -

30

CONFIDENTIAL

PLOVDIV

MANUFACTURES:

Cotton yarn.

State Cotton-Spinning and Weaving Factory,

VASIL KOLAROV

GABROVO

[No indication as to type of product]

State Spinning Factory,

BULGARIYA

SOFIA

MANUFACTURES:

High-grade cotton yarn.

State Industrial Enterprise,

GEORGI KIRKOV

SOFIA

MANUFACTURES:

Different kinds of ~~first~~ quality cotton yarn.

State ~~Woolen~~ Wool Factory, (Cotton-spinning and weaving)

RAYKO DAMYANOV

GABROVO

MANUFACTURES:

~~First~~ quality cotton goods.

CONFIDENTIAL

State Spinning Factory

SLAVYANSKO EDINSTVO

GABROVO

MANUFACTURES:

All kinds of high-grade ~~fleece-wool~~ yarn for
weaving and knitting.

State Industrial Enterprise,

BRIGADA

GABROVO

MANUFACTURES:

Reconditioned wool.

State Cotton-Spinning, ~~Vieugna-Wool~~ and Knitting Factory,

BURYA

GABROVO

MANUFACTURES:

All kinds of cotton and ~~vieugna-wool~~ yarn, high-
grade cotton knitted goods.

State Textile Factory,

23 DEKEMVRI

GABROVO

MANUFACTURES:

Cotton yarn, high-grade knitted goods, stockings, and
sewing thread.

State Cotton Yarn-Factory,

BALKAN

GABROVO

MANUFACTURES:

All kinds of cotton yarn; (Modern dyeing).

State Industrial Enterprise,

ISKRA, (Factory for ~~dry goods and machines~~)

PLOVDIV

MANUFACTURES:

All kinds of ~~dry goods~~ in its various departments;
has at its disposal complete sets of machines for all kinds of light ~~and~~
~~quadr~~ products. All orders are executed quickly, punctually; production
is of high quality.

State Industrial Enterprise,

FAZAN

RUSE

MANUFACTURES:

All kinds of stockings (cotton and silk), high-
grade knitted goods, cotton gloves.

State Factory,

BABA ZARA

GABROVO

MANUFACTURES:

All kinds of woollen-knitted goods.

State Knitted-Goods Factory,
 DOBRI KARTALOV
 GABROVO

MANUFACTURES:

All kinds of knitted goods, woollen gloves,
 woollen stockings.

State Industrial Enterprise for Lumber-Processing,
 KARPATI
 RUZE

MANUFACTURES:

Home and office furniture; carpentry (doors and
 windows); school benches; wood-shavings (for production of hats and
 for packaging); packaging (crates for packaging); agricultural equip-
 ment (winnowing machines).

State Cotton-Yarn Factory
 STOYAN BUCHVAROV
 GABROVO

No indication as to type of product

State Industrial Enterprise,
 PAMUCHNA PREZHDA, (Cotton-yarn Factory)
 TRYAVNA

MANUFACTURES:

All kinds of cotton yarn.
 (National champion of the cotton-yarn-producing enterprises in Bulgaria
 at the "First of May" competition in 1949)

State ~~Factory~~ for Cotton-Yarn,
 PHRISTO BOTEV
 VARNA

MANUFACTURES:

All kinds of commercial and industrial yarn.
 At the factory there is a well organized nursery and a boarding-house
 for the young working girls.

State Cotton-~~Yarn~~ Factory,
 BURGASKA PREZHDA
 BURGAS

MANUFACTURES:

All kinds of cotton yarn.

State Industrial Enterprise,
 BORIS Kh. SOTIROV
 (Formerly - JOINT-STOCK COMPANY; SLATINA)
 SAMOKOV

MANUFACTURES:

Cotton cloth.
 (HAS OPENINGS FOR TEXTILE TECHNICIANS.)

State Textile Factory,
 REKORD

Railroad Station GORNA ORYAKOVITSA

MANUFACTURES:

All kinds of cotton yarn and cotton cloth.

State Industrial Combine,
Ministry of Industry,
PAMUCHNI TUKANI - TRIKOTAZH
SOFIA,

Boulevard Slivnitsa 164-a

PRODUCES AND SELLS HIGHEST-GRADES:

Cotton cloth (all kinds);
~~ready-made~~ knitted-goods (of cotton yarn and artificial silk); stock-
ings (of cotton yarn, artificial and natural silk); ~~dry-goods~~ of all
kinds; all kinds of cotton and silk dyed textiles; ~~dress~~es and ~~stamped~~
~~patterns~~ of all kinds of cotton cloth.

(Through competition and shock-working, we will fulfill our
quota of the Five-Year Plan in 4 years)

Textile Factory,
1 MAY (For cotton spinning and weaving)
VARNA

MANUFACTURES:

Industrial and packaged cotton yarn, and different
kinds of cotton cloth.

State Stockings-Factory,
YORDANKA CHANKOVA
SOFIA

MANUFACTURES:

All kinds of men's, ladies', children's cotton
stockings and high-grade ladies' silk stockings.

State Industrial Enterprise,
PROLETARII
SOFIA

MANUFACTURES:

High-grade cotton and silk-knitted goods.

State Factory for ~~Stockings~~,
VULCHO IVANOV
SOFIA

MANUFACTURES:

All kinds of high grade ladies' and men's cotton
stockings and socks of ~~knitted~~ and imported yarn.

State Cotton-Weaving Factory,
TEKSTILNA SLAVA
SOFIA

MANUFACTURES:

All kinds of cotton cloth.

State Industrial Enterprise,
VULKO CHERVENKOV
GABROVO

MANUFACTURES:

All kinds of cotton cloth: Percale, Oxfords,
Chiffon, Panama, Vichy, etc.

(The factory has a complete and modern installation for
dressing cloth.)

State Cotton-Weaving and Dressing Factory,
 GEORGI DIMITROV
 SOFIA

TWO SECTIONS:

Weaving - All kinds of cotton cloth.

Dressing - Includes reconditioning all kinds of cotton cloth, bleaching, mercerizing, stamping with modern machines, finishing (dry and wet dressing) of all kinds of velvets, fleecy cloth, flannels, etc.

State Factory,

"SOKOL"

GABROVO

MANUFACTURES:

First-quality cotton cloth and vicugna wool yarn.

State Factory,

TEKSTILIYA

Village of BICHKINYA

GABROVO

MANUFACTURES:

All kinds of cotton cloth.

State Cotton-Knitted Goods Factory,

"PETKO KUNIN"

GABROVO

MANUFACTURES:

All kinds of cotton-knitted goods (ready-made).

27

35

State Industrial Enterprise,
 CHERVENA ZVEZDA
 Village of BICHKINYA
 GABROVSKO

MANUFACTURES:

All kinds of knitted goods (cotton, wool and
 cotton-wool mixture).

State Industrial Enterprise,
 MARITSA, (Textile Factory)
 PLOVDIV

HAS:

WEAVING, DYEING, DRESSING, MERCERIZATION, BLEACHING, FIN-
 ISHING.

Also, production and recondition of high-grade cotton cloth.

State Weaving Factory,
 PLOVDIV
 PLOVDIV

MANUFACTURES:

All kinds of high-grade cotton cloth.

State Cotton-Weaving Factory,
 "RODINA"
 TRYAVNA

MANUFACTURES:

All kinds of cotton cloth.

State Factory for Stockings,

OSMI MART

SLIVEN

MANUFACTURES:

Men's, Children's, Ladies' stockings and socks.

State Industrial Enterprise,

FAZAN

RUSE

MANUFACTURES:

All kinds of stockings, high-grade knitted goods, cloth gloves.

State Weaving Factory,

VELA PISKOVA

RUSE

MANUFACTURES:

All kinds of cotton, linen, and hemp cloth.

(DYEING, RUBBERIZING, DRESSING)

State Terry-Cloth Factory,

OBORISHTA

PANAGYURISHTA

MANUFACTURES:

Terry robes, towels for babies, and all kinds of terry cloth towels.

State Factory for Cotton Cloth and Dyeing,

VILKO

(Formerly - LAMBRI VLADKOV)

TURNOVO

MANUFACTURES AND DYES:

Cotton cloth.

State Factory for Hemp Products,

EDINSTVO

PLOVDIV

MANUFACTURES:

Cord, Manila, Ropes, Yarn.

State Industrial Combine,

Ministry of Industry,

KONOPENA, LENENA I KOPRINENA INDUSTRIYA (Hemp, Flax and Silk Industry)

SOFIA,

Ulitsa Tsar Osvoboditel 8

MANUFACTURES:

Hemp yarn and cloth, flax thread, yarn and cloth,
silk yarn and cloth.

AND CULTIVATES AND SELLS:

The new fiber-producing plant "RAMI",
which gives twice as much fiber as hemp.

State Industrial Enterprise,
DUNAVSKA KOPRINA
RUSE

MANUFACTURES:

All kinds of silk yarn for the weaving industry
and for the production of stockings; yarn manufacture; moulinsage.

State Textile Factory,
CHERVENA ZVEZDA
(Formerly - KIRIL)
VARNIA

MANUFACTURES:

All kinds of horse blankets, sacks, tobacco
packaging materials, ropes, shoemakers' thread, cords, etc. Rugs,
small rugs and narrow carpets (Persian type and others), plush, velvet,
rugs; terry velbet, linen and cotton cloth; canvas; belting, etc.

State Factory,
GEORGI KIRKOV
KAZANLUK

MANUFACTURES:

Hemp, jute and flax products; sacks for wheat,
rice, sugar and flour; elevator bands; upholstering bands; ~~chairs~~
bands; tobacco canvas; shoemakers' thread.

State Combine,
VELA PEEVA
PAZARDZHIK

CONFIDENTIAL

(RUBBER FACTORY, HEMP SPINNING ESTABLISHMENT, COTTON AND
HEMP WEAVING ESTABLISHMENTS)

State Industrial Combine,
Ministry of Industry,
DURVCOBRABOTVASHTA INDUSTRIYA
SOFIA,

Ulitsa Sordika 13

The State Industrial Combine, DURVCOBRABOTVASHTA INDUSTRIYA,
coordinates, plans and manages the production of all ~~lumber~~ -processing
industrial enterprises in the ~~People's Republic~~ Republic Bulgaria. From Bulgarian
forest lumber, these industrial enterprises process these products for
the ~~home~~ and foreign markets, ~~as classified below:~~

(a) SAWMILL PRODUCTION:

All kinds of coniferous and ~~larch~~
processed material - planks, beams, two by fours, steam-treated beech,
strips, rough lumber and ties.

(b) PLY-WOOD PRODUCTION:

1. Ply-wood - all thicknesses, dry and wet gluing.
2. Cabinet and chair planks with different padding.
3. Ply-wood and fascines - all kinds.
4. Seats and backs for chairs.
5. Pressed wood.

(c) COOPER AND PACKAGING PRODUCTION:

1. All kinds of oak barrels and vats
2. All kinds of packaging articles - vats for pulp, cases,
crates, small cases, etc.

CONFIDENTIAL

(d) ~~CARPENTRY~~, CABINET MAKING:

1. Manufactures all kinds of massive and frame furniture (bedroom furniture), wardrobes, office furniture, dining-room furniture, chairs (ordinary, Viennese, semi-Viennese, office, etc.).
2. Performs internal and external furnishing of homes, halls and shops.
3. Manufactures wooden-houses.

(e) DIFFERENT KINDS OF PRODUCTION:

1. Parquet - all kinds and dimensions.
2. Sports equipment - skis, discs, javelins, sledges, wooden-horses, etc.
3. Chassis for trucks, buses, carriages and carts.
4. Shoe-forms and heels.
5. Weaver's shuttles, cardboard spoels, spools, reels, etc.
6. All kinds of brushes.
7. Tooth-picks and shoe-braces.
8. Different articles, with Bulgarian pyrographic designs.

All visitors to the Thirteenth International Sample Fair at Plovdiv will have the opportunity to acquaint themselves with the production of the Lumber-Processing Enterprises, by visiting the various exhibits.

State Cooper and Sawmill Enterprise,
GOCHO IVANOV
BURGAS

MANUFACTURES:

All kinds of coopered vessels, ~~coopered~~ and transportation barrels, beer and pulp vats, tubs, small-size tubs, etc. made

CONFIDENTIAL

to contain from 10 to 50,000 liters, as well as all kinds of cooper vessels for export.

MANUFACTURES ALSO:

All kinds of cooper staves; inlaid flooring; planks of different sizes and dimensions, etc.

State Brush Factory,

OLIGAN

SOFIA

MANUFACTURES:

All kinds of high-grade brushes.

State Industrial Enterprise,

SHPERPLATNA INDUSTRIYA

GORNA, DZHUMAYA

PLY-WOOD FACTORY FOR:

Ply-wood, Veneer and other high-grade

plane-surface wood.

State Furniture Factory,

9 SEPTEMBRI

BURGAS

MANUFACTURES IN THE:

1. Furniture Section - bedroom, kitchen, office and other furniture.
2. Building Section - all kinds of carpentry work.

CONFIDENTIAL

3. Chairs Section - popular type chairs.
4. Packaging Section - all kinds of packaging crates - fishmen's, for vegetables, for soap, etc.

State Chair Factory,

NAPREDUK

PLCVDIV,

Ulitsa Gladston 48

MANUFACTURES:

All kinds of chairs and furniture. All kinds of packaging articles.

State Industrial Enterprise,

LIPA,

SILISTRA

THE DEPARTMENTS ARE:

Furniture, Construction and Carriage Building.

State Cooperage Factory,

DUB

PAZARDZHIK

MANUFACTURES IN THE:

Cooper Section - ~~camp~~ and transportation barrels, fermentation vessels, tubs, small-size tubs, vats, pulp vats, etc.

CONFIDENTIAL

Furniture Section - all kinds of furniture;
sets, on order, and ready-made.

(SOLID CONSTRUCTION! FIXED PRICES!)

State Industrial Enterprise,

BENKOVSKI

(Formerly - DEBRI PLAT Limited Corporation)

TETEVEN

MANUFACTURES:

High-grade plywood.

State Furniture Factory,

IZKUSTVO

TRYAVNA

MANUFACTURES:

All kinds of furniture and carpentry work.

State Industrial Enterprise,

UZANA

QABROVO

MANUFACTURES:

Finished-lamch material for ~~the home~~ market and

~~for export~~; packaging products - pulp vats, cases, cases for lard,
cases for explosives, cases for ~~Bombard~~ wick, etc. Semi-Viennese
chairs; reels for thread.

State Industrial Enterprise,

PARQUET INDUSTRY - DUB

BURGAS

CONFIDENTIAL

CONFIDENTIAL

MANUFACTURES:

Pure oak parquet from Strandzha-mountain lumber,
precision dried and processed on the most modern machines.

Steaming in special washeries of beech wood, for
export and manufacture of furniture.

State Furniture and Packaging Factory,
STARA-ZAGORA

MANUFACTURES IN THE:

1. Furniture Section - bedroom sets; dining-room sets; office sets; parlor, kitchen and office furniture.
2. Packaging Section - pulp vats, ditch cases, ~~double and triple cartridges~~, cages, different small-size tubs, packaging crates, etc.
3. Construction Section - Carpentry items; doors and windows.

State Industrial Combine,
Ministry of Industry,
KONSERVNA INDUSTRIYA
SOFIA,

Boulevard Aleksadur Stamboliyski 49

COORDINATES AND DIRECTS 40 ENLARGED STATE INDUSTRIAL ENTERPRISES
WHICH MANUFACTURE THE FOLLOWING:

CONFIDENTIAL

CONFIDENTIAL

Canned vegetables, canned fruit, frozen vegetables, frozen fruit, jam preserves and jellies, pectin, sweetened and unsweetened marmalades, tomato puree, ground red pepper, fruit juices and syrups, dehydrated fruit, dehydrated vegetables, raisins, honey, wild-rose flour, pulps and concentrates, mixed pickles in-vinager and sauerkraut, canned meat and fish, bacon and lard, salami and sausages.

(POSSESSES A WELL ORGANIZED SCIENTIFIC AND RESEARCH LABORATORY AND A DISPLAY AND ADVERTISEMENT STORE IN SOFIA.)

State Industrial Enterprise,
VITAMINA / CANNING COMBINE
Railroad Station KRICHIM

MANUFACTURES:

High-grade canned vegetables, jam preserves,
jellies, etc.

(HIGH-QUALITY! PRECISION IN MANUFACTURE!)

State Industrial Enterprise,
PROLETARKA ()
PLOVDIV

MANUFACTURES:

Dehydrated fruit and vegetables, first-quality;
ground red pepper.

State Vacuum - Canning Factory,
PARTIZANIN ()
PURVOMAY

MANUFACTURES:

Red pepper, tomato puree, dehydrated fruit and vegetables, pulps, jellies, jam preserves, all kinds of canned vegetables, ground red pepper.

(BY THE QUALITY OF ITS PRODUCTS, IT HOLDS FIRST PLACE IN THE
REPUBLIC)

State Vacuum Factory,

PLOVDIV

Railroad Station FILIPOVO

MANUFACTURES:

Canned vegetables, compotes, tomato puree, marmalades, ground red pepper, ~~etc.~~

State Industrial Enterprise,

SEPTENVRI

PLOVDIV

MANUFACTURES:

All kinds of dehydrated fruit and vegetables, marmalades, purees, raisins' honey, and paprika.

(A MILL FOR RED PEPPER AND WILD ROSE FLOUR)

State Canning Factory,

PLOVDIVSKA KONSERVA

PLOVDIV,

Ulitza Filip Makedonski 49

MANUFACTURES:

Red pepper, tomato puree, dehydrated fruit and vegetables, pulps, jellies, jam preserves, all kinds of canned vegetables, ground red pepper.

(BY THE QUALITY OF ITS PRODUCTS, IT HOLDS FIRST PLACE IN THE REPUBLIC)

State Vacuum Factory,

PLOVDIV

Railroad Station FILIPOVO

MANUFACTURES:

Canned vegetables, compotes, tomato puree, marmalades, ground red pepper, etc.

State Industrial Enterprise,

SEPTENVRI

PLOVDIV

MANUFACTURES:

All kinds of dehydrated fruit and vegetables, marmalades, purees, raisins' honey and paprika.

(A MILL FOR RED PEPPER AND WILD ROSE FLOUR)

State Canning Factory,

PLOVDIVSKA KONSERVA

PLOVDIV,

Ulitsa Filip Makedonski 49

CONFIDENTIAL

FIRST BULGARIAN FACTORY FOR THE MANUFACTURE OF:

Canned vege-

tables, compotes, marmalades, purees, etc.

State Refrigeration-Canning Combine,

PURVI MAY

PLOVDIV

FOR:

Deep freezing of fruit, vegetables, fruit juices, meat,
fish, poultry, etc.

MANUFACTURE OF:

Marmalades, jellies, jam preserves, syrups,
pulp, etc.

ALL KINDS OF FRUIT AND VEGETABLE CONCENTRATES.

State Canning Combine,

YANKO KOSTOV

VARNA

MANUFACTURES:

All kinds of canned meats, fish, vegetables and fruit.

State Industrial Enterprise,

BAIKAN

TRIAVNA

MANUFACTURES:

High grade marmalades, pulp, jam preserves and
jellies.

CONFIDENTIAL

CONFIDENTIAL

State Canning Combine,

YAGODA

YAMBOL

IS SUPPLIED WITH THE LATEST MACHINES FOR THE MANUFACTURE OF:

Tomato

puree, ground red pepper, canned vegetables, marmalades, jam preserves,
canned meats, dehydrated fruit, mixed pickles in vinegar and all other
different products of fruit and vegetables.

State Vacuum-Canning Factory,

YANTRA

Railroad Station GORNA-OREKHOVITSA

MANUFACTURES:

All kinds of canned vegetables and fruit; compotes,
jam preserves, marmalades, tomato puree, canned vegetables, mixed pickles,
in vinegar, etc.

Canning Factory,

SLAVYANKA

BURGAS

MANUFACTURES:

All kinds of canned fish, meats, vegetables, fruit
in hermetically sealed containers and produces salted and smoked fish.

State Industrial Combine,

Ministry of Industry,

KHIMICHESKA INDUSTRIYA

SOFIA

CONFIDENTIAL

COORDINATES ALL THE INDUSTRIAL CHEMICAL ENTERPRISES IN THE
COUNTRY.

State Industrial Enterprise,
AGRO - KHIMICHESKA INDUSTRIYA
PLOVDIV

PRODUCES:

I. ANTI-PARASITE COMPOUNDS:

- (a) For safeguarding vegetation: Insecticide,
(Liquid), ~~fruit carbolic acid~~.
- (b) For safeguarding animals: Sumitol (~~sulfamate~~),
~~Agriamin~~ ~~solid form~~.
- (c) For safeguarding humans: Antiscab, (Liquid),
Pedipete (~~liquid~~).
- (d) Anti-hemorrhoids compound: Rectane (Liquid).
- (e) Poison for mice and rats: Zinc Phosphate.
- (f) Pyrethrum compound: Insectos.

II. DISENFECTANTS:

Creoline, Virusan (Liquid).

III. SOAPS:

~~Mechanized~~ (Treated with - nicotine, resin,
sulfur, and the borax compound Rabetnik).

IV. INSTALLATION FOR PRODUCING:

Nicotine extract and
extractions for producing oils and shortenings
from raisins, tomatoes, anise, "ccleader", etc.
seeds.

CONFIDENTIAL

State Soap Factory,

1930
1930K

PLOVDIV

MANUFACTURES:

All kinds of soap for ~~laundring~~ toilet soap,
in pulp form, and soap compound in powder form.

State Chemical Works,

GEORGI DIMITROV

Railroad Station KOSTINBROD

MANUFACTURE:

Vegetable oils, solidified oils, textile oils,
~~consistent oils~~, fodder, joiners' glue, bone flour, soap, glycerine,
perfumes.

State Pencil Factory,

KHEMUS

BURGAS

MANUFACTURES:

Pencils - All kinds of lead pencils, indelible and
crayon-indelible pencils, and crayons for drawing.

Carbons - For typewriters and ~~handwriting~~.

Ribbons for Typewriters - All dimensions and colors.

Ink - For schools, for documents, and especially
for fountain-pens, ~~and~~ different colors ink.

Office Glues.

Water Colors and Charcoal - for drawings.

Plastering Chalk (white and colored).

State Industrial Enterprise for Dry Distillation of Wood,

GORKHEM

RILSKI MONASTIR

PRODUCES:

Methyl alcohol (wood alcohol), beech tar, asphalt,
tar oils (purified and heavy), calcium acetate, asphalt ^{coating} lacquer, and
retort charcoal [residue from distillation].

State Chemical Factory,

DROBINKA

VARNA

PRODUCES:

Zinc ^(all types) oxide, Lead minium, Lead ^{enamel} paint, ^{for painting}

State Industrial Enterprise,

ELOVITSA-ROSITSA

GABROVO

FACTORY FOR:

Explosives, fuses and distillates [etc.]

State Chemical Factory,

SIN KAMUK

STARA-ZAGORA

PRODUCES:

Copper sulphate, zinc sulphate, and ^{various salts} ~~mineral~~.

CONFIDENTIAL

(SUPERIOR QUALITY PRODUCTS)

State Industrial Enterprise For Sodium and Hydrogen,

STARA

ZAGORA

PRODUCES:

Compressed hydrogen; calcium carbonate, precipitated.

State Vinegar Factory,

IZOREV

YAMBOL

PRODUCES :

First quality, aromatic wine and alcohol, vinegar,
for consumption and for industrial uses.

State Factory,

SEPTENVRI

STARA-ZAGORA

MANUFACTURES:

All kinds of plaster, mineral dyes, linseed, and lacquers, linseed oil, paints, enamels, lacquers, cold casein glue, etc.

State Industrial Enterprise,

VOLOV

SHUMEN

MANUFACTURES :

Pencils, inks, india-ink, glues, water colors,
pastels, chalk, ^{and} wax, ^{and} paste for stoves, ^{and} plasticin, ^{and} signaling-char-
coal, ^{and} resin for violin bows, paint for school blackboards and dyes for eggs.

State Carbide Factory,
Railroad Station ILIYANTSII

PRODUCES:

Calcium carbide.

State Industrial Combine,
Ministry of Industry,
KOJARSKA I KAUCHUKOVA INDUSTRIYA
SOFIA,

Ulitza Ivan Vazov 20

THE STATE INDUSTRIAL COMBINE DIRECTS, CONTROLS AND REPRESENTS
THE AFFILIATED STATE INDUSTRIAL ENTERPRISES OF THE FOLLOWING INDUSTRIES:

Fur, Shoe-manufacturing, rubber, glove-manufacturing, and the
travel-bags and ~~bag~~-manufacturing industry.

AND PRODUCES:

Tires for cars, motorcycles and bicycles; rubber
foot-wear, technical articles, medical equipment; leather goods for
clothing and for technical uses; lamb hides; imitations of exotic hides;
local game hides; shoe-leather; transmission belts; furs for clothing;
different kinds of foot-wear; travel-bags and hand-bags (great variety
of all kinds and dimensions); gloves; pocket-books; purses.

Foot-Wear Plant,
9 SEPTEMVRI
SOFIA

MANUFACTURES:

All kinds of shoes, travel-bags, hand-bags, pocket-
books, purses, knapsacks, and all kinds of leather goods.

CONFIDENTIAL

State Rubber Plant,

G. DIMITROV

SOFIA,

Voenna Rampa

MANUFACTURES:

Tires for cars, motorcycles and bicycles, foot-
wear, etc.

State Leather Factory,

23 DEKEMVRI

SOFIA

MANUFACTURES:

Finished leather.

(HIGH QUALITY, PRECISION WORK)

State Industrial Enterprise, For Rubber Goods,

PROF. PETKO KUNIN

PLOVDIV

MANUFACTURES:

Ladies', men's, children's, rubber foot-wear,
sandals, "ralki", galoshes, snow-boots, water-hose, rubber rims for
fiacre wheels, rubber corks for spraying apparatus, technical equip-
ment, rubber wire, rubber bands for cans, etc.

State Rubber Factory,

IBONIT

PAZARDZHIK

MANUFACTURES:

Peasants' sandals, summer cloth-shoes,

CONFIDENTIAL 47 -

58

children's snow-boots, sandals, stoppers and other rubber goods.

State Rubber Factory,

ELIEDZHIX

PAZARDZHIX

MANUFACTURES:

Rubber foot-wear, goods.

State Industrial Enterprise,

ETERNIT, Rubber Factory

RUSE

MANUFACTURES:

Technical Rubber Goods.

State Industrial Enterprise, Rubber Factory,

LUV

BURGAS

MANUFACTURES:

All kinds of high quality rubber foot-wear and
different kinds of rubber cloth.

State Industrial Enterprise,

BULD. KOZHUKHARSKA INDUSTRIYA

Railroad Station ISKUR

LEATHER FACTORY:

For dressing all kinds of sheep and game hides.

CONFIDENTIAL

State Leather Factory,
DIMITUR BLAGOEV
GABROVO

MANUFACTURES:

Sole-leather, crude leather, etc.

State Leather Factory,
GEORGI KIRKOV
GABROVO

MANUFACTURES:

All kinds of smooth leather.

State Leather Factory,
IZOREV
GABROVO

MANUFACTURES:

High grade leather from sheep and game hides.

State Industrial Enterprise, Leather Factory,
BULGARIYA
GABROVO

MANUFACTURES:

Shoe-lining leather and shoe-leather (kid and
calf leather).

State Leather Factory,
1 MAY
GABROVO

CONFIDENTIAL

MANUFACTURES:

Sole-leather.

State Leather Factory,

VASIL KOLAROV

PLOVDIV,

Ulitsa Chirpansko Shose 8

MANUFACTURES:

Leather-clothing of chromed, impregnated
and dyed lamb hides.

State Leather Factory,

VASIL LEVSKI

GABROVO

MANUFACTURES:

Transmission belts, pickers, fixtures, etc.

State Leather Factory,

23 DEKEMVRI

STARA-ZAGORA,

KVARTAL INDUSTRIALEN (INDUSTRIAL QUARTER)

MANUFACTURES:

Crude leather, peasants' sandals, sole-leather,
burlap.

State Industrial Enterprise,

9 SEPTEMBRI

RUSE

CONFIDENTIAL

MANUFACTURES:

Sole-leather, crude leather, calf leather, kid leather, transmission belts, pickers, ~~fixtures~~, etc.

State Leather Factory,

9 SEPTEMBER

Railroad Station GORNA ORYAKHOVITSA

PROCESSES ALL KINDS OF:

Lamb, goat, sheep and game hides.

State Leather Factory,

PURVI MAY

GOVERNMENT TURNOVO

MANUFACTURES:

Black and natural leather.

State Industrial Combine,

Ministry of Industry,

"KHRANITELNA INDUSTRIYA"

SOFIA,

Ulitsa Alabin No 29

COORDINATES:

Factories for Extracting and Pressing (with Re-fineries) for Obtaining Vegetable Oils for Consumption and Industrial Uses.

ENTERPRISES FOR THE PRODUCTION OF ~~FOOD~~ PRODUCTS:

Macaroni,

Ravioli, Noodles in star-shape, and rice-paste.

CONFIDENTIAL

CONFIDENTIAL

ENTERPRISES FOR THE PRODUCTION OF: Vinegar.

ENTERPRISES FOR THE PRODUCTION OF: Beer (Breweries).

ENTERPRISES FOR THE PRODUCTION OF: Pressed yeast ~~cake~~ for bread.

ENTERPRISE FOR THE PRODUCTION OF: Vegetable Casein, used as glue in the plywood industry.

ENTERPRISE FOR THE PRODUCTION OF: Sodium Bicarbonate, Acetic acid.

ENTERPRISE FOR THE PRODUCTION OF: Yeast for cheese.

FOOD-INDUSTRY COMBINES.

State Oil Factory,

PURVENETS

PLOVDIV

MANUFACTURES:

All kinds of vegetable oils and linseed oil.

State Industrial Enterprise,

"SLAVYANKA"

Railroad Station KASPICHAN

MANUFACTURES:

Macaroni, noodles, star-shaped noodles, ravioli,

dough-grains, rice-noodles, etc.

State Oil-Refining Factory,

"NEDELCHO NIKOLOV"

STARA-ZAGORA

MANUFACTURES:

Refined sun-flower oil, oil cake, and soap residue.

CONFIDENTIAL

State Factory for ~~Baggy~~ Products,

23 DEKEMVRI

VARNIA

MANUFACTURES:

All kinds of macaroni, noodles, rice-noodles,
star-shaped noodles, etc.

State Oil-Deriving Factories,

ZORA and RAMONA

VARNA

MANUFACTURES:

Refined sun-flower oil, technical oils and linseed
oils.

State Oil-Deriving Factory,

SUNTSI

SHUMEN

MANUFACTURES:

Refined sun-flower oil, husks, and ~~"seatschok"~~.

State Mill and Oil-Deriving Factory,

DIMITUR BLAGOEV

AYTOS

MANUFACTURES:

Refined sun-flower oil, fatty acids, seed-
shells, and flour.

(GUARANTEED QUALITY)

CONFIDENTIAL

CONFIDENTIAL

State Industrial Combine,
Ministry of Industry,
ZAKHAR I ZAKHARNI IZDELIYA
SOFIA,

Ulitsa Ekzarkh Iosif 19

~~TO THE COMBINE ARE ATTACHED AND ORGANIZED OTHER COMBINES~~
AND FACTORIES FOR THE PRODUCTION OF THE FOLLOWING:

- I. Sugar Combines - All kinds of sugar in lumps, crystals, powder;
as secondary products; molasses and dehydrated
sugar-beets slices.
- II. Factories for Sugar Products - All varieties of high grade
sugar products, chocolate,
biscuits, chocolate candy,
sugar candy, Turkish delight,
halva, waffles, marzipan, etc.
- III. Factories for Shortening and Glucose - Glucose, all kinds of
~~facile food~~ specialties, desert shortening,
dextrin, crystallized glue, shoemaker's wax, etc.
- IV. Distilleries - Manufacture all kinds of alcohol.
- V. Other Factories Attached to the Combines - vegetable oils, lin-
seed oil, potassium, ~~carbonic acid~~, dif-
ferent chemicals, refractory products, bricks,
tiles, etc.

CONFIDENTIAL

CONFIDENTIAL

State Industrial Enterprise, Sugar Factory,
VASIL KOLAROV
PLOVDIV

MANUFACTURES:

Sugar (Lump sugar, powder sugar).

State Sugar Works,
G. ORYAKHOVITSA

FACTORIES FOR:

Sugar (all kinds), Alcohol (all kinds), Sugar-
Beets slices (Pressed), Potassium (raw and re-
fined), Carbonic acid, and ~~other~~ fire-resistant
products.

(SECTION, ORBIS - FACTORIES FOR:

Sugar and chocolate products,
all kinds glucose, different kinds of ~~fecula~~ and dextrin.)

State Industrial Enterprise,
REKORD
PLOVDIV

MANUFACTURES:

Chocolate, sugar products, Turkish delight, biscuits,

halva, etc.

State Factory,
POKELA
PLEVEN

CONFIDENTIAL

MANUFACTURES:

High grade sugar products.

State Industrial Combine,

Ministry of Industry,

STROITELNI MATERIALI

SOFIA,

Boulevard Georgi Dimitrov No 20

FACTORIES ATTACHED TO THE COMBINE MANUFACTURE:

Cement, ~~brick~~

lime, ~~slaked lime~~, oil cloth for covers, kitchen porcelain ~~ware~~ of all kinds, all kinds of glassware, sandstone pipes, mill stones, grinding wheels, sharpening stones, ~~porcelain-electric accessories~~, mineral paints, all kinds of ~~plaster~~ (for construction, for tiles and for dental uses); glazed, terra-cotta and sandstone slabs, high and low-tension insulators, ~~fire-resistant~~ materials, mirrors and polished glass, cement pipes and plates, "heraclite", windowpane glass, sanitary faience.

State Cement Plant,

GRANITOID

MANUFACTURES:

Portland cement and construction ~~plaster~~.

State Glass Factory,

PETOLUCHKA

GABROVO

MANUFACTURES:

Mirrors and etched, linear, polished and opaque glass for furniture.

CONFIDENTIAL

State Glass Factory,

STUKIO

SOFIA

MANUFACTURES:

Hollow glassware (Dance-decanter, large decanters,
jars, and bottles).

State Industrial Combine,

Ministry of Industry,

MARSILSKI KEREMIDI

SOFIA,

Ulitsa Tsar Kaloyan 10

COORDINATES AND DIRECTS THE ENTERPRISES IN THE REPUBLIC WHICH

MANUFACTURE DIFFERENT KINDS OF:

Bricks and tiles (Hand-made and

machine-made).

State Ceramics Factories,

TRAKIYA

PLOVDIV

MANUFACTURE:

First quality bricks, tiles, lids, and other

ceramic products.

State Ceramics Factory,

23 DEKEMVRI

GABROVO

MANUFACTURES:

All kinds of machine-made and hand-made ring tiles.

CONFIDENTIAL

CONFIDENTIAL

Combined Ceramics Factories,

MIZIYA

Village of KALTINETTS

GORNIO-ORYAKHOVSKO

MANUFACTURE:

Marseilles tiles, covers, ~~machine-made bricks~~

and hand-made bricks.

State Combined Ceramics Factories,

TUNDZHA,

YAMBOL

MANUFACTURE:

Marseilles tiles, covers, ~~machine-made bricks~~

and hand-made bricks.

State Industrial Combine,

KNIZHNO-MUKAVENA INDUSTRIYA

SOFIA,

Ulitsa Graf Ignatiev 18

MANUFACTURES THE FOLLOWING VARIETIES OF PAPER, CARTON AND

BRISTOL BOARD:

~~From~~ cellulose (white for illustrations, for posters, for ledgers ~~(Books)~~); Cellulose ~~cartons~~ - white and of different colors; White printing paper (semi-fine satin and non-satin); Newsprint (in rolls and sheets); Colored paper (for forms); Colored paper (for posters); All kinds of packaging paper (hygienic, superior, Natron, Havana); Natron paper (for bags, cord and yarn); ~~Cartons~~ (duplex, triplex and for machines ~~(Haltape)~~); Bristol board (for weaver's

CONFIDENTIAL

spools; Different kinds of paper for bags; Bristol board / Jacquard,
brown, straw and grey "Prespan"; Bristol board for book covers;
"Pergamyn" and parchment.

(CONDITIONS PAPER AND CANTON IN ITS INDUSTRIAL BINDERIES
AND SPECIAL ENTERPRISES.)

Gato Industrial Enterprise,

RODOPI

PLOVDIV

MANUFACTURES:

Paper, bristol board, and paper bags.

CONFIDENTIAL

Export Associations:

boulevard
 State Tobacco Monopoly, Sofia, "Al. Stamboliyski" 18.
 Bulgarplodeksport (Bulgarian Fruit Export), Sofia, Ulitsa (Street) "Iv. Vazov" 3.
 Khraunksport (Food Export), Sofia, Ulitsa "Gladston" 39.
 Bulgarrudeksport, (Bulgarian Ore Export), Sofia, Ulitsa "Rakovski" 137.
 Bolgarskaya Roza (Bulgarian Rose), Sofia, Ulitsa "Iv. Vazov" 3.
 Yaytsentsentral', ~~XX~~ (Egg Center), Sofia, Ulitsa "Alabin" 56.
 Kozhetsentral' (Hide Center), Sofia, Ulitsa "Gladston" 44.
 Raznoiznos (Miscellaneous Export), Sofia, Ulitsa "Tsar Asen" 1.

Import Associations:

Metallimport (Metal Import), Sofia, Ulitsa "Slavyanska" 2.
 Khimimport (Chemical Import), Sofia, Ulitsa "St. Karadzha" 2.
 Industrial'import (Industrial Import), Sofia, Ulitsa "Alabin" 50.

CONFIDENTIAL

71

THE MISSION THAT ORIGINATED THIS REPORT -- Warsaw, Trybuna Ludu, 3 Mar 51

The Taynaya Niesiya motion picture was produced by Mosfilm in the USSR in 1950. Scenario by K. Isayev and M. Mamlyarskiy, directed by M. Romm, Photography by B. Velichan, and music by A. Khachaturian.

"I believe that I will be expressing the sentiments of all here if I extend my deepest gratitude to our guest for the great help he and his friends gave us, captains of German industry, during the war."

In the motion picture Taynaya Niesiya, these words are spoken by Schacht, the leader of Hitler's financial interests, to an American senator at a reception given by Krupp in Essen on March 1942.

The purpose of this motion picture is to show the true aspect of Wall Street politics. This film, based on facts and documents, recalls how the representatives of the governments and the financiers of the USA and Great Britain carried on secret negotiations with the German fascists even during the World War II. The subject of these negotiations was preparation for a new war against the Soviet Union.

Capital knows no boundaries. It can even cross enemy lines in time of war.

The REINWAFFELUNG consisted of the transfer of the war in 1942 to the Atlantic, towards the coast, along the Rhine, and a part of Poland, the Soviet army was driven over the Hitler divisions on the eastern front, outwards, over the Carpathians and the Vistula River, to the Baltic. On the western front, the American and the English armies were then redeployed at speed under the pressure of a few German divisions.

At the beginning of January 1945, a plane, carrying the gentlemen with Portuguese passports, landed at the Berlin airport. The American secret mission went into action.

What were the aims of the mission? First, to achieve the secret surrender of Hitler's armies in the west for the continuation of the war by them in the east. Second, to obtain German patents and turn them

CIA
FOREIGN DOCUMENT DIVISION

Report U-1575

THE NEW YORK TIMES

REDACTED

3 March 1961

THE MISSION THAT CAME TO THE FRONT -- Warsaw, Trybuna Ludu, 3 Mar 51

The Taynaya Missiya motion picture was produced by Mosfilm in the U.S.S.R. in 1950. Scenario by K. Isayev and M. Raskyarskiy, directed by M. Romm, Photography by B. Volchen, and music by A. Khachaturian.

"I believe that I will be expressing the sentiments of all here if I extend my deepest gratitude to our guest for the great help he and his friends gave us, captains of German industry, during the war."

In the motion picture Taynaya Missiya, these words are spoken by Goebbels, the leader of Hitler's financial interests, to an American senator at a reception given by Krupp in Essen on March 1945.

The purpose of this motion picture is to show the true aspect of anti-front politics. This film, based on facts and documents, recalls how the representatives of the governments and the financiers of the U.S. and Great Britain carried on secret negotiations with the German fascists even during the World War II. The subject of these negotiations was preparation for a new war against the Soviet Union.

Capital knows no boundaries. It can even cross enemy lines in times of war.

The Taynaya Missiya deals with the changes of the war in the U.S.S.R. After liberating Romania, Bulgaria, almost all of Hungary, and a part of Poland, the Soviet army was fighting over 100 Hitler divisions on the entire front from Budapest, over the Carpathians and the Rhine River, to the Baltic. On the western front, the American and the British armies were then retreating at a rapid pace under the pressure of a few German divisions.

At the beginning of January 1945, a plane, carrying the gentlemen with Portuguese passports, landed at the Berlin airport. The American secret mission went into action.

What were the aims of the mission? First, to achieve the secret surrender of Hitler's armies in the west for the continuation of the war by them in the east. Second, to obtain German patents and turn them

over to the American capitalists. Third, to bribe Hitler spies, operating in the Balkans, and to entrust them with diversionary work for the benefit of the U.S. On the list of spies, the names of Rankovich and members of Tito clique were not absent.

The film Taynaya Missiya goes straight to the bottom of the dollar diplomacy of American leaders, and is an artistic portrayal of the key to the secret negotiation between the U.S. and Hitler, no longer secret.

Then we look at Western Germany today and see the prison gates being opened with deference for the Krupp, who are expanding the arsenal of World War III under the protectorate of Truman and Eisenhower, then the events shown in the motion picture become even clearer to us.

"I am the manager of the National Socialist Party, and I am selling this party to you." So speaks Hermann in the motion picture to an American senator on the secret mission. He states further: "These people will be indispensable to you. They are well trained in the art of murder and dyin'. And, above all--and this is most important to you--they hate Bolshevik Russia."

The leaders of the Third Reich grouped around Hitler are a repulsive lot, and the Taynaya Missiya portrays them with great realism. Hitler, Goebbels, Himmler, and Speer are shown in the film as the main conspirators for the plan to sell Germany to America - and Hitler's financiers, including Krupp, Goebbels, Vossler, Bae, and partners - are the ones who sold Wall Street bankers and Truman, their spokesmen, wished to war against the Soviet Union.

Even back in 1941, Harry Truman, then a member of the American Senate stated: "When we see Germany winning, we must aid Russia. When Russia, however, is winning, then we must aid Germany."

The man who spoke that today occupies the Presidential chair at the White House in Washington. Winston Churchill, war-singer Number One, aids Truman in his murderous plans. Churchill, too, played a significant role in the history of that secret mission. He, too, is shown in the motion picture as one of the world arsonists. The bust of Napoleon, which

the direct or placed on his desk, is intended as a warning.

Opposed to this world of enemies of mankind, the motion picture shows Soviet characters-Dementiyev and Masha as spies, masquerading as members of a gangster group. They externalize heroic action in the defense of freedom and world peace.

The motion picture also portrays the other type of German people, the German Communists assiduously fighting in the ranks of the defenders of justice and peace.

The role of the American aviator, who refuses to aid the secret mission, is limited to an episode in the picture, but the episode has deep significance. In the final scenes, we see this pilot in a crowd in New York cheering the victory over fascism. The American senator, who attended the secret mission, recognizes the aviator from the window of his automobile, which cannot proceed because of the jubilant crowd. The senator's face is shadowed with uneasiness. He is frightened at the face of the other America, which is a menace to the evil representatives of the Imperialist world and cynical dealers of death such as he.

The authors, basing the story on facts and documents, were able to bring out the deep political meaning of the subject in sharp relief. The director contributed greatly with clever use of contrast and emphasis and with excellent casting.

The roles of the English warrenners interpreted by M. Vysotskiy, as Churchill, and P. Gyzdebarov, as Kozlov, Churchill's closest confidante, are well played. The hypocritical and cynical American senator attending the secret mission is played by M. Komissarov. In his role he portrayed all the typical American characteristics of the capitalists who dictate Washington's policies. The role of an American spy, another member of the secret mission, is convincingly played by S. Vecheslav. P. Borozov as the cold, sadistic Himmler, V. Bolorukov as the sly, greedy Bormann, M. Porchovskiy as the gorilla Kaltenbrunner, and A. Pelevey as Schellenberg, the chief of Hitler's intelligence, play their roles excellently. The gallery of criminals is completed by the uncrowned

king of bourgeois Germany, Krupp von Bohlen, played by actor A. Khokhlov, and the "brains" of the German industrialists Schacht, played by N. Svobodin. V. Guselev, playing the role of Hitler, the fascist maniac, occasionally lapses from his sharp portrayal. V. Makarov as Demant'yev, and E. Kuzmina as the Soviet spy Masha, represent in the motion picture a better world--the world of the patriotic struggle for freedom and the moral beauty of the Soviet man.

Kuzmina is excellent as the Soviet spy Masha, as Geradin; as the Gestapo agent Marta, but is less effective in love scenes.

The excellent scenery in the motion picture deserves special merit, particularly scenes of the Soviet army offensive in Poland, retreat of the Anglo-American armies in the west, and, later on, the surrender of the Hitler garrisons brought about by the success of the secret mission.

The panorama of Berlin ruins and fires are most impressive and very ably aided by Khachaturian's music. This music is an essential element of the motion picture. Each of the scenes, portrayed in the motion picture, is represented by its own dominant motif, which recurs during the dramatic moments. Similarly, the camera can emphasize the atmosphere of the scenes with variable lighting effects.

There is plenty of satire in the motion picture.

The motion picture is being shown in Poland with a Polish language sound track. The dialogue is well-written and the actors' delivery is good, but the technical execution is not very good.

This motion picture unmasks the warmongers, their base methods of provocation, treachery, spying, and their plans for World War III even as World War II was coming to an end. The motion picture Taynaya Missiya serves the movement for peace.

The truth of this motion picture is confirmed by current events. Its reality grows with each passing day.... Irena Morz

CONFIDENTIAL

C I A

FOREIGN DOCUMENTS DIVISION

Oct 1951

50X1-HUM

Bibliography for the Periodical
"Automation and Telemechanics"

Avtomatika i Telemekhanika,
No 2, 3, 4, 5 (1951)

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

AVTOMATIKA I TELEMEXHANIKA1941Vol. 6, No. 2, 1941

1. "Stalin Prize Winners" (Editorial)

THEORETICAL PROBLEMS OF AUTOMATICS AND TELEMECHANICS

2. KOVALENKOV, V. I., Prof, Corr Memb Acad Sci USSR
"Application of Four-Terminal Network Theory to the Analysis of Complex
Magnetic Circuits"
3. SHESTAKOV, V. I., Cand Physico-Math Sci
"The Algebra for Two-Terminal Systems, Constructed Exclusively From
Two-Terminal Networks (Algebra of A-Systems)" (Thesis for Candidate's
Degree read at the Moscow State University imeni M. V. Lomonosov)

ELEMENTS OF AUTOMATICS AND TELEMECHANICS

4. LIVSHITS, M. A., Prof, Dr Tech Sci, KLYUYEV, N. N., Engr, and PANCYTSEV,
A. P., Engr
"Elements of Non-contact Electrical Master-Selector Devices"
5. TAGER, P. J., Prof, Dr Tech Sci
"Light Relays"
6. SOTSKOV, B. S., Docent
"Heat Relays"
7. VITENBERG, M. I., Docent
"Time Constant of Code Relays"
8. VITENBERG, M. I., Docent
"DC Inductance of Relays"
9. PONOMAYENKO, V. K., Docent
"Calculation of the Form of Poles for Dynamometric, Induction and
Electromagnetic Relays"

- 1 -

CONFIDENTIAL

CONFIDENTIAL

10. CYGENZIMT, D. I., Docent
"The Magnetic Field in the Iron Core of Circular Cross-Section When the
Circuit is Opened"
11. YELISEYEV, E. M., Engr
"Efficient Construction of Electromagnets for Regulators and Relays"

INFORMATION

12. VITENBERG, M. I., Docent
"Monograms for the Calculation of Telephone Relay Windings"
13. KHRUNOV, N. P., Engr
"Effective Application of Alternating Current Relays for STaF Equipment
on USSR Railways"

CONFIDENTIAL

CONFIDENTIAL

AVTOMATIKA I TELEMEXHANIKAVol 6, No 3, 1941THEORETICAL QUESTIONS OF AUTOMATICS AND TELEMECHANICS

1. KOVALENKOV, V. I., Prof, Corr Memb Acad Sci USSR
"Electromagnetic Processes Along a Symmetrical Cluster of Conductors"
2. AYZERMAN, M. A., Cand Tech Sci
"The Effect of Dry (Coulomb) Friction Forces on the Movement of Indirect-Acting Automatic Regulators"
3. BOGOMOLOV, V. A., Engr
"The General Equation for Bridge Circuits with Linear Resistances"

ELEMENTS OF AUTOMATICS AND TELEMECHANICS

1. LANTAU, P. H., Docent, Cand Tech Sci
"Determination of the Form of a Repeated Signal at the Output of the Band-Pass Filter"
2. GAYDAR, D. S., SOVOKA, V. Ye.
"The Silver Sulphide Photocell"
3. TRITCHEVSKIY, R. Ye., Engr
"A Photoelectric Phase-Impulse System"
4. IVANOV, V. I., Engr
"Equipment for Pulse Testing of Relays"

AUTOMATICS AND TELEMECHANICS IN THE NATIONAL ECONOMY

5. POPOV, V. K., Prof^{Dr} Tech Sci
"Transient Conditions in Automatic Ionic Electric Drives"
6. BEON, O. B., Prof^{Dr} Tech Sci
"Transient Conditions of an Induction Motor in Connection with the Operation of Alternating-Current Contactors"

- 3 -

CONFIDENTIAL

CONFIDENTIAL

10. KAZANTSEV, I. M., Docent, Cand Tech Sci
"Systems for Automatic Control of Direct-Current Electric Drives
for Metal-Cutting Machines as a Set of Elementary Units"
11. ANTOCHIN, A. A., Docent, Cand Tech Sci
"Measurement of the True Temperature of Heated Gases with the
Help of Exhaust Thermocouples"
12. KOVAL'CHIK, I. L., Engr, KAVCHIK, B. V., Engr
"Automatic Control and Regulation of Processes at Dressing and
Gold-Extracting Factories"
13. KAROVICH, Ye. A., Engr
"High-Frequency Checking of Glaze on Electric Transmission Lines"

INFORMATION

14. GOSLOPCHIK, I. Ye., Prof
"Metrolological Prerequisites for the Automatic Process Control in
the Production of Threaded Parts"
15. SOKOLOV, A. A., Cand Tech Sci
"On the Use of Amplifier Tubes in Electronic Automatic Control Circuits"
16. KRAUZ, S. V., Engr
"A Small Automatic Central Electric Power Station"
17. DERAFRUN, L. L., Engr
"Remote Control of a Model Boat" (from the English)
18. KAROVICH, Ye. A., Engr
"Simple Pulse Circuits" (from the English)

- 4 -

CONFIDENTIAL

CONFIDENTIAL

19. AYZENMAN, M. A., Cand Tech Sci
Review of B. I. Rubin and Yu. G. Zheynman's book, "Principles of
Aviation Automatics"
20. YAKIMENKO, M. M., Cand Tech Sci, STANISLAVSKIY, S. I., Engr
Review of N. A. Livshits, B. V. Spitsyn, and A. V. Danilin's book,
"Theory and Calculation of Elements of Automatic Systems"
21. "In the Department of Technical Sciences, Academy of Sciences USSR"

- 5 -

CONFIDENTIAL

CONFIDENTIAL

Vol 6, No 4-5, 1961THEORETICAL QUESTIONS OF AUTOMATICS AND TELEMCHANICS

1. KOVALENKO, V. I., Prof

Corresponding Member of the Academy of Sciences USSR

"Means and Prospects for the Development of a General Theory
of the Transmission of Electromagnetic Energy Along Wires"

2. BYAKOV, V. A., Cand Tech Sci, IVANOV, V. I., Cand Tech Sci

"The problem of a General Theory of Transmission of Electrical
Energy Along Lines"3. SOLODOVNIKOV, A. A., Prof^{Dr} Tech Sci

"Selection Coding and Methods for Calculating its Elements"

4. PONOMAREV, E. I., Engr

"Analysis of the Dynamics of Regulation Processes with the Help
of Electric Models"MEMBERS OF AUTOMATICS AND TELEMCHANICS

5. ABITYANOV, V. O., Engr

"A New Compensating-Generator Telemetering System"

6. ZAKS, L. M., Engr, MIL'SHTEYN, V. N., Cand Tech Sci

"The Problem of Evaluating the Sensitivity of Electromagnetic Relays"

7. KUSHNIR, Yu. M., Engr, KAVEBIN, P. F., Engr

"A New Method of Utilizing Photocells in Automatics and Telemechanics"

- 6 -

CONFIDENTIAL

CONFIDENTIAL

AUTOMATIZATION AND TELEMECHANIZATION IN THE NATIONAL ECONOMY

8. MIRIMANOV, B. G., Cand Tech Sci
"Existing Criteria of Frequency Regulation in Large Power Associations
and an Analysis of Their Usefulness in the Construction of Regulators"
9. CHEVONNETS, Ya. M., Engr
"Automatic Control in Hydroelectric Power Stations"
10. BOGOMOLOV, V. A., Cand Tech Sci
"Automatic Control of the Power of Hydroelectric Stations According
to Water Flow"
11. GAFZAN, A. B., Engr
"Characteristics of Automatic Regulated Reclosing of Electrical
Transmission Lines"

INFORMATION

12. GRUBEN, L. I., Engr
"Automatic Traction Substations in Electrified Railways"
13. LINENSON, D. Ya., Engr
"Direct Acting Voltage Regulators" (from the English)
14. KAPOVICH, Ye. A., Engr
"New Uses of Relays with a Magnetic Contact" (from the English)
15. KAPOVICH, Ye. A., Engr
"The Operation of Commutator Invertors"

CONFIDENTIAL

CONFIDENTIAL

CRITICISM AND BIBLIOGRAPHY

16. POPOV, V. K., Prof Tech Sci
"Automatics and Telemechanics in the Pages of the Journal
'Elektrichestvo' for 1940 and 1941"
17. LOSHITSKIY, V. L., Cand Tech Sci
Review of V. A. Philippov's Book "Automatic regulation of Ventilating
Units"
18. AGROSKIN, A. A., Docent, Cand Tech Sci
"Review of D. I. Kustov, Ye. A. Paperny, Yu. B. Kab, and Z. I. Mirkin's
Book 'Handbook for the Operation of Measuring and Regulating
Instruments in Coke By-Product Plants in the USSR'"

- E N D -

- 8 -

CONFIDENTIAL

RESTRICTED

C I A

FOREIGN DOCUMENTS DIVISION

22 Oct 1951

50X1-HUM

Table of Contents of the Soviet Periodical

"Journal of General Chemistry"

Zhurnal Obshchey Khimii, No 1-6, 1939

[This report has not been edited
or prepared for publication.]

RESTRICTED

RESTRICTED

JOURNAL OF GENERAL CHEMISTRY

1939

Vol. IX (LXXI), No. 1, 1939

"On the Theory of Cation Exchange of Ferantites I"

N. L. Radakov

Industrial Institute

Odesa

Received 30 April 1938

"On the Theory of Cation Exchange of Ferantites II"

N. L. Radakov

Industrial Institute

Odesa

Received 30 April 1938

"On the Theory of Cation Exchange of Ferantites III"

N. L. Radakov

Industrial Institute

Odesa

Received 20 April 1938

"Hydrogenation of Certain Homologues of Benzene Under Pressure of
Hydrogen II"

V. V. D'yakova and A. V. Lomovoy

Institute of Combustible Minerals, Academy of Sciences USSR

Laboratory of Hydrogenation

Received 5 May 1938

"Condensations of Aldehydes and Ketones with Aromatic Compounds
in the Presence of Aluminum Chloride -- I. Condensations

RESTRICTED

RESTRICTED

of Ketones of the Aliphatic Series with Phenols"

I. E. Tsukervanik and Z. M. Nazarova

Laboratory of Organic Chemistry, Central Asian State University

Received 3 May 1938

"Alkaline Splitting of Ketones of the Naphthalene Series"

L. G. Il'ina

Belorussian State University

Received 7 May 1938

"On the Anesthetic Derivatives Convolvulin and Convolvamine"

B. G. Galimovskiy and R. A. Kononova

Alkaloid Department, Scientific-Research Chemicalo-Pharmaceutical

Institute Acad. S. G. Zhukovskiy

Received 13 May 1938

"Syntheses of α - and γ -~~40~~xylophenyls -- α - and γ -oxydiphenyl-
~~Sulfonic~~ Sulfonic Acid and Its Derivatives"

M. M. Voronitsov, Jr. and A. T. Troshchinskii

State Institute of High Pressures

Received 23 May 1938

"On the Question of the Importance of Cation and Anion in the
Solvation and Deliquescence Processes in Liquid Ammonia"

I. B. Vasil'yev, M. A. Portnov and A. N. Zhuravlev

State Institute of Applied Chemistry

Leningrad

Received 2 May 1938

"Oxidation of Cholesterol and Trans-dehydroandrosterone By Tetroxide

~~W~~ (Osmium)"

RESTRICTED

V. I. Ushakov and A. I. Lyutenberg

All-Union Institute of Experimental Medicine named A. M. Gorkiy

Laboratory of the Chemistry of Steroids

Received 9 May 1938

"The Structure of Boron Hydride"

L. Ye. Karonosov

Moscow State University named Plokhovskiy

Received 25 May 1938

"Thermal Analysis of the System Hydroxide -- Urea"

V. J. Gorbunov

Laboratory of General and Inorganic Chemistry, Moscow Chemical

Technological Institute named Mendeleev

Received 13 May 1938

"Dev Vladimirovich Piskunovskiy"

A. I. Brodskiy

Vol. XX (XXI), No 3, 1938

"Catalytic Oxidation of Cyclohexylmethylamine as a Method of
Obtaining It"

I. I. Lenarskiy

Laboratory of Organic Chemistry, Agricultural Academy named

K. A. Timiryazev

Moscow

Received 19 May 1938

"On the Properties of Peroxides in Oxidized Paraffin"

A. K. Plisov

Laboratory of Organic Chemistry, Krasnodarsk Chemico-Technological

RESTRICTED

RESTRICTED

Institute of the Fat Industry imeni Molotov

Received 25 May 1938

"On the Thermal Effect of Distribution"

V. F. Pershke and A. V. Lakedemonskiy

Laboratory of Physical Chemistry, Moscow Institute of Non-Ferrous
Metals and Gold

Received 27 May 1938

"Reaction of the p-PhenyleneDiamine and Its Derivatives with Salts
of Diazonium -- III. Conversion of Salt of Disazolum"

L. G. Ische and V. Ya. Solov'yevskiy

Laboratory of Dyes, Leningrad Order of the Red Banner Chemical-
Technological Institute

Received 28 May 1938

"On the Polymerization of Derivatives of 5-Vinylnaphthalene"

S. Zonis

Laboratory of Organic Chemistry, Leningrad Order of the Red Banner
Chemical-Technological Institute

Received 27 May 1938

"On the Alkaloids of ^{Magnolia}~~Musha~~ Discata"

N. F. Proskurnina and A. I. Orskov

Alkaloid Department, Scientific-Research Chemical-Pharmaceutical
Institute imeni S. Ordzhonikidze

Received 3 June 1938

"Research in the Field of the Structure of Aniline Black --

III. Structure and Mechanism of the Formation of the Willstätter
Imines"

RESTRICTED

I. S. Ieffe and V. Ya. Soloveyehik
 Laboratory of Dyestuffs, Leningrad Order of the Red Banner Chemical-
 Technological Institute
 Received 28 May 1938

"On Certain New Derivatives of Diphenyl-*p*-phenylenediamine"
 I. S. Ieffe and V. Ya. Soloveyehik
 Laboratory of Dyestuffs, Leningrad Order of the Red Banner Chemical-
 Technological Institute
 Received 28 May 1938

"On the Question of the Structure of Petrolic Acid"
 A. A. Chernomyrva
 Gvozdenitskii Industrial Institute
 Received 31 May 1938

"Catalytic Transformations of Heterocyclic Compounds --
 XI. Mechanism of the Common Catalytic Degradation of Furan
 and Pyranidine (Tetrahydropyran) with Secondary and Tertiary
 Amines"

Yu. K. Yur'yev
 Moscow State University
 Laboratory of Organic Chemistry (head Academician N. D. Zelinskii)
 Received 3 June 1938

"Condensations of Furanic Compounds -- IX. Intectics of Ketone-
 Phenolic Systems and the Fixing Among Them of Oxonium
 Complexes"

V. V. Chelintsev and V. and G. Kuznetsov
 Received 7 June 1938

RESTRICTED

RESTRICTED

"Research in the Di- and Polyarylethane Series -- I. Di-^p-
Xenylethane and Its Derivatives"

Ye. A. Bailov and Yu. K. Yudin

Laboratory of Organic Chemistry, Ivanovo-Chernovo-Chemico-Technological
Institute

Received 7 June 1938

"Research in the Di- and Polyarylethane Series -- II. Synthesis
of 1,2,3,4-Tetra-^p-Xenylbutanedione-1,4 and Tetra-^p-
Xenylurea"

Yu. K. Yudin

Laboratory of Organic Chemistry, Ivanovo-Chernovo-Chemico-Technological
Institute

Received 7 June 1938

"Compressed^{ed} Catalysts"

P. Ivannikov

State Institute of High Pressures

Received 7 June 1938

"Esters of^(iso-) Oleic Acids"

A. A. Chernoyarova

Novocherkassk Industrial Institute

Received 7 July 1938

"On Acids and Bases"

M. Usanovich

Laboratory of Physical Chemistry, Central Asian State University

Laboratory of General Chemistry, Committee on Science of the ^{Council of People's} ~~People's~~

Commissars, Uzbek SSR

Received 7 June 1938

RESTRICTED

RESTRICTED

Vol IX (LXXI), No 3, 1939

"On Fixation of Hydrogen Chloride on Methylphenylethylene"

S. F. Lagerov and A. A. Shamsurin

Uzbek State University

Received 1 March 1938

"Determination of Small Concentrations of Electrolytes by Intensity
of Current in a Closed Circuit -- I"

S. A. Kashkovan

Laboratory of Physical Chemistry, Ukrainian Central Institute
of Hygienics and Occupational Diseases

Khar'kov

Received 25 March 1938

"Determination of Small Concentrations of Electrolytes by Intensity
of Current in a Closed Circuit -- II. The Stabilizing Effect
of Silver Nitrate in Relation to Nitrates"

S. A. Kashkovan

Laboratory of Physical Chemistry, Ukrainian Central Institute of
Hygienics and Occupational Diseases

Khar'kov

Received 25 March 1938

"On the Mechanism of the Action of Sulfuric Acid on the Olefins"

V. Gutyrva

Laboratory of Organic Synthesis, Azerbaijan Scientific-Research
Institute Imeni V. V. Kuybyshev

Baku

Received 13 May 1938

- 7 -
RESTRICTED

RESTRICTED

"Conditions for the Formation of Hydrosols -- II"

N. H. Andreyev

Chair of Chemistry, Academy of Military Medicine imeni Virov

Received 23 June 1938

"Isomerization of Polymethylenic Hydrocarbons Under the Influence
of Aluminum Chloride -- I. Isomerization of Propylcyclopentane"

N. S. Turova-Polyak and O. I. Polyakova

Laboratory of Organic Chemistry imeni Academician N. D. Zelinskii,

Moscow State University

Received 21 May 1938

"On the Cyclodehydration of Certain Substituted Camphenylalcohols"

E. A. Arbuzov

Laboratory of Organic Chemistry, Kazan Chemical Scientific-Research

Institute imeni Butlerov

Received 26 February 1938

"Research in the Field of Isomerization of Oxides of Terpenes --

II. Isomerization of α -Pinene Oxide in the Grignard Reaction"

E. A. Arbuzov

Laboratory of Organic Chemistry, Chemical Scientific-Research

Institute imeni A. M. Butlerov

Received 27 February 1938

"Research in the Field of Isomerization of Oxides of Terpenes --

III. Isomerization of Camphene Oxide, Nopinene and Δ^3 -Carene in
the Reaction of S. M. Reformatskiy"

E. A. Arbuzov

Laboratory of Organic Chemistry, Chemical Scientific-Research

Institute imeni A. M. Butlerov

RESTRICTED

RESTRICTED

Received 27 February 1938

"Isomerization of Allenic Hydrocarbons with Silicates -- VIII. The
Experiment on the Isomerization of 1-Phenylbutins - 3 and
1-Phenylbutadiene-1,3"

Ya. M. Glukhina

Academy of Military Medicine ^{of the Red Army} ~~Scientist~~ S. M. Pirov

Received 23 June 1938

"Hydrogenation of Hexylene Under High Pressure of Hydrogen"

A. P. Nikoleyeva and P. V. Puchkov

Laboratory of Hydrogenation, Institute of Combustible Minerals,

Academy of Sciences USSR

Received 19 June 1938

"Hydrogenation of Ethylbenzene Under High Pressure of Hydrogen"

P. V. Puchkov and A. P. Nikoleyeva

Laboratory of Hydrogenation, Institute of Combustible Minerals,

Academy of Sciences USSR

Received 19 June 1938

Vol IX (LXXI), No 4, 1938

"Local Anesthetic Compounds of the Quinolinc-4-Carboxylic Acid
Series"

S. I. Lorige

Laboratory of Chemistry and Technology of Organic Substances (men)

Professor A. I. Berkhovskiy, Moscow Institute of Fine Chemical

Technology

Received 7 June 1938

RESTRICTED

RESTRICTED

"Reaction of Sodium Amide With Aromatic Ketones In Fusion"

I. Kh. Greynlin and T. G. Iulanova

Laboratory of Organic Catalysis, Institute of Organic Chemistry,

Academy of Sciences USSR

Received 7 June 1938

"On the Action of Nitrous Acid on α -Branched Butyrolactones"

V. V. Pechilaktov and A. S. Onishchenko

Institute of Organic Chemistry, Academy of Sciences USSR, Laboratory

of Academician N. Ya. Dem'yanov

Received 7 June 1938

"On the Action of Phenylisocyanate Chloride on α -Branched Butyrolactones"

V. V. Pechilaktov and A. S. Onishchenko

Institute of Organic Chemistry, Academy of Sciences USSR, Laboratory

of Academician N. Ya. Dem'yanov

Received 7 June 1938

"On the Reaction of α -Cyanobutyrolactone with Phenylisocyanate Chloride"

V. V. Pechilaktov and A. S. Onishchenko

Institute of Organic Chemistry, Academy of Sciences USSR, Laboratory

of Academician N. Ya. Dem'yanov

Received 7 June 1938

"Synthesis of Oxypoline (Oxyl Pyrrolidine- α -Carboxylic Acid)"

V. V. Pechilaktov and A. S. Onishchenko

Institute of Organic Chemistry, Academy of Sciences USSR, Laboratory

of Academician N. Ya. Dem'yanov

Received 3 June 1938

- 10 -
RESTRICTED

RESTRICTED

Cyclopropanone
 "On the Question of ~~Cyclopropanone~~"

N. Ya. Dem'yanov and V. V. Perfilovskiy

Institute of Organic Chemistry, Academy of Sciences USSR, Laboratory
 of Academician N. Ya. Dem'yanov

Received 7 June 1938

"Research in the Field of Acetylenic Chlorhydrines and the
 Corresponding Dioxides and Erythrines"

N. A. Gerasimova

Laboratory of Organic Synthesis, Institute of Organic Chemistry,
 Academy of Sciences USSR

Moscow

Received 23 June 1938

"On the Method of Study of Terpenes and on the Composition of
 Fushkov Resin of Turpentine Oil"

Yu. S. Zaitkind and A. G. Bolavskiy

Leningrad Scientific-Research Institute of Plastics
Undated

Vol. IX (LXXI), No. 5, 1939

"On the Question of the Determination of Atomic Weight of Lead by
 the Richards-Hönlenschmid Method -- II. On the Obtaining of
 Chemically Pure Lead Chloride as an Objective for the
 Determination of the Atomic Weight of Lead"

V. N. Permyakov

Radium Institute, Academy of Sciences USSR

Received 17 July 1938

Isomeric
 "Research in the Field of ~~Isomeric~~ Transpositions in the Unsaturated
 Aliphatic Halogen Derivatives -- The Action of Hydrochloric
 Acid on Dimethyl ~~Acetylenyl~~ *Acetylenyl* Carbinol in the Presence of Ammonium

RESTRICTED

RECEIVED

Cupric
Chloride and Chloride or Cuprous Chloride"

T. A. Gayorskaya

Laboratory of Organic Chemistry, Scientific-Research Chemical
Institute, Leningrad State University

Received 30 May 1938

"Splitting of Acetylenic Glycols by the Action of Potassium Carbonate"

A. T. Babayan

Institute of Chemistry, Armenian Affiliate, Academy of Sciences USSR

Yerevan

Received 26 May 1938

"A Study of the Acids of the Milky Juice of the Milkwort Euphorbia
Stenandrosa Solms -- II. On the Structure of Stenandrosic
Acid"

V. I. Vityayev

Laboratory of Chemistry, Department of Plant Raw Material, Botanical
Institute, Academy of Sciences USSR

Received 14 June 1938

"Research in the Field of Pyrrole Derivatives -- I. Syntheses of
Certain N-Alkyl-^{*Substituted*} 2,5-Dimethylpyrrol-3(4)-Monocarbon
Esters"

N. M. Pimoshevskaya

Institute of Chemistry, Kharkov State University imeni A. M.

Gor'kiy, Laboratory of Professor Yu. V. Korshun

~~Director of the Work, Professor K. V. Rod~~

Received 14 June 1938

"Derivatives of Benzothiazol -- III. On Certain Derivatives of
2-Aminobenzthiazol"

RECEIVED

RESTRICTED

N. S. Drozdov and V. I. Stavrovskaya
Laboratory of the Chemical Division, Tropical Institute
Moscow

Received 20 June 1936

"On the Alkaloids Salsola Nienteri -- IV"

N. F. Proskurnina and A. P. Grekhev
Alkaloid Department, Scientific-Research Chemico-Pharmaceutical
Institute L. I. Sengor Ordzhonikidze

Received 21 July 1938

"Influence of Temperature on Distribution Coefficients of Saturated
Monocarboxylic Acids ^{between} water and Organic Solvents"

A. Bekturov
Kazakh State University
Received 27 June 1936

"Isomerization of Polymethylene Hydrocarbons Under the Influence
of Aluminum Chloride -- II. Isomerization of Methylcyclopentane"

M. E. Kurova-Polyak and N. B. Laranovskaya
Laboratory of Organic Chemistry imeni Academician N. D. Zelinskiy,
Moscow State University

Received 29 June 1936

"Action of Warm Alkali Concentrates on Biglandulic Acid"

N. P. Kir'yakov
Laboratory of Chemistry, Department of Plant Raw Material, Botanical
Institute, Academy of Sciences USSR

Received 29 June 1938

"On the Reaction of α -Oxide of Cholesterol with Methylmagnesium ^{Iodide}"

M. I. Ushakov and O. S. Madayeva

RESTRICTED

RESTRICTED

All-Union Institute of Experimental Medicine imeni A. M. Gor'kly,

Laboratory of the Chemistry of Sterols

Received 1 July 1930

"Research in the Field of Aldehyde Acids and Aldonol Lactones --

I. An explanation of the Possibility of the Condensation
of Aconic Acid with Aldehydes and Ketones"

N. M. Shemyakina and I. A. Red'kin

Laboratory of Organic Chemistry, All-~~Union~~^{Union} Institute of Experimental
Medicine

Moscow

Received 2 June 1938

"On the Catalytic ~~Transpositions~~^{Transformation} of Certain Homologues of Cyclopentane"

B. A. Kazanskly and S. R. Serdyukenko

Institute of Organic Chemistry, Academy of Sciences USSR

Division of Academician N. D. Zelinskly

Received 2 July 1938

"The Differentiating Action of Solvents on the Strength of Acids --

I. Potentiometric Titration of Salts by the method of
Substitution in the Differentiating Solvents"

N. A. Izmaylov and M. A. Bel'gova

Laboratory of Physical Chemistry, Ukrainian Institute of Experimental

Pharmacy

Khar'kov

Received 17 July 1938

"The Structure and Properties of ~~Organic Compounds of High Molecular~~^{High-molecular}
~~Weights~~"

V. V. Razymovskiy

Undated

RESTRICTED

- 14 -

RESTRICTED

"Test of the Application of the Grignard Reaction on α - β -
Unsaturated Ketones -- I."

V. I. Yesafev

Laboratory of Organic Chemistry, Sverdlovsk State University

Received 20 June 1958

"In memory of Academician V. S. Gulevich" (1867 - 1953)

I. A. Smoredintsev

Vol. IX (LXXI), No 6, 1959

"On the Synthesis and Analysis of Vanadium Sulfides"

Ye. I. Gerasimov and I. K. Churikhina

Laboratory of Chemical Thermodynamics, *USSR Moscow State University*

Received 2 July 1958

"Research in the Field of Aldehyde Acids and Aldonol Lactones --

II. Synthesis of γ -Oxy- β -Phenyl- γ -Aldonol Lactone

(3-Oxy-4-Phenylfuran-2-One)"

N. M. Shemyakin

Laboratory Organic Chemistry, All-Union Institute of Experimental

Medicine

Received 2 July 1958

"Research in the Field of Aldehyde Acids and Aldonol Lactones --

III. On Certain Specific Characteristics of γ -Aldonol

Lactones and Unsaturated Aldehyde Acids"

N. M. Shemyakin

Laboratory of Organic Chemistry, All-Union Institute of Experimental

Medicine

Received 2 July 1958

RESTRICTED

- 15 -

RESTRICTED

"Catalytic Cyclization of Paraffin Hydrocarbons on Platinized
 Oxide"

B. A. Kazanskiy and A. F. Plame

Institute of Organic Chemistry, Academy of Sciences USSR

Division of Academician N. D. Zelinskiy

Received 2 July 1938

"On the Acetylation of 9,10-Dioxystearic Acids and on the
 Diastereoisomeric ~~Transformations~~ ^{Transformations} of the Latter by the Action
 of Acetic Anhydride"

N. I. Yezafay

Laboratory of Organic Chemistry, Sverdlovsk State University

Received 3 July 1938

"On the Isomerization of Normal Hexane ^{into} ~~into~~ Dimethyl ~~ethyl~~ ^{ethyl}ethylene"

A. D. Petrov and V. Shevukin

Laboratory of the Chair of Organic Chemistry, Gor'kiy State
 University

Received 3 July 1938

"Synthesis and Properties of α -Methyl-n-Heptyl-Benzene,
 α -Butyl-n-Propyl-Benzene and α -Hexyl-n-Heptyl-Benzene"

A. D. Petrov and Students A. P. Baydanov, N. N. Zakotin and P. I.
 Suntsov

Laboratory of the Chair of Organic Chemistry, Gor'kiy State
 University

Received 3 July 1938

"Electrolysis of the Potassium Salt of Tiglic Acid"

A. D. Petrov and Student D. A. Vyskhirev

Laboratory of the Chair of Organic Chemistry, Gor'kiy State

RESTRICTED

RESTRICTED

University

Received 3 July 1938

"On the 4-Methylstyrene and Its Hydration"

A. I. Shavrygin

Laboratory of Organic Chemistry, Moscow Institute of Fine

Chemical Technology

Received 3 July 1938

"On Nitro Compounds Sensitive to Light -- VI. Certain Derivatives
of Nitronaphthalene with Ortho- and Para-Order Sulfur-containing
Substituents"

N. M. Voroshtsov, V. V. Pozlov and I. S. Travkin
Laboratory of Dyes, ~~2025~~ ^{Moscow Chemical-Technological Inst.} ~~2025~~ ^{General D. I. Mendeleev}

Received 7 June 1938

"Solubility of Zinc and Cadmium Nitrates in ^{Liquid} ~~Acetone~~ ~~Solvent~~"

D. I. Donskaya and M. A. Portnov

State Institute of Applied Chemistry

Leningrad

Received 7 July 1938

"Condensations of Furanic Compounds -- X. Chalcone-like Furanic
Systems"

V. V. Chelintsev

Saratov State University

Received 11 July 1938

"On the Color Reactions of Polyphenols with the Salts of Niobium
and Tantalum"

M. F. Krivoslykov and M. S. Platonov

RESTRICTED

- 17 -

RESTRICTED

Chair of Analytical Chemistry, Leningrad Order of the Red Banner

Chemico-Technological Institute

Received 14 July 1938

"On Certain Physical Constants of Mixtures of Hydrocarbons -- II."

A. V. Logovoy, E. K. Plyskova and T. I. Stepanitseva

Received 14 July 1938

"Oxidation of Petroleum Products at High Temperatures --

I. Oxidation of Solar Oil"

A. E. Plisov and M. D. Grebennikova

Laboratory of Organic Chemistry, Chemico-Technological Institute

Krasnodar

Received 14 July 1938

"On the Thioacylic Derivatives of Primary Amines (Synthesis of

✓ Carbocyanic Acyclic Polymers"

I. I. Kuznetsov and I. V. Rozvadovskaya

Laboratory of Organic Chemistry, Military Academy of Chemical

Defense, ~~of the Red Army~~ *of the Red Army* Vereshilov

Moscow

Received 15 July 1938

"Exchange of Sodium and Calcium Ions in *Glauconite*"

F. M. Chulkov

Chair of Physical and Colloid Chemistry, Saratov State University

Received 15 July 1938

RESTRICTED

Proj: 9976

C I A
FOREIGN DOCUMENTS DIVISION

20
5 Oct 1951

50X1-HUM

50X1-HUM

Tables of Contents of the 1939-1942 Issues (Volumes 16-19)
of Astronomicheskii Zhurnal

Astronomicheskii Zhurnal Volumes XVI-XIX
Editor: V. F. Resenkov, Moscow and Leningrad,
January 1939-December 1942.

[Note: This report has not been edited or prepared for publication.]⁷

TABLES OF CONTENTS OF THE 1939-1942 ISSUES (VOLUMES 16-19)
OF ASTRONOMICHESKIY ZHURNAL

Editor: V. F. Fesenkov

[Note: The following is the table of contents of the 1939, 1940, 1941, and 1942 issues (Volumes 16 to 19) of Astronomicheskii Zhurnal, which is published 6 times a year, at Moscow and Leningrad, by the Academy of Sciences USSR Press. The editor is academician V. F. Fesenkov. Most of the articles are followed by a summary in English. Volume 16 (1941) contains only two issues; namely, Nos 1 and 4-5.]

Astronomicheskii Zhurnal Vol 16, No 1, 1939	pages 3-27
S. V. Orlov, "Evolution and origin of comets"	
I. S. Astapovich, "Methods of meteoric astronomy as applied to the study of the stratosphere"	28-41
V. V. Fedynskiy, "Use of the observations of luminous night clouds made from one station" (submitted 1937)	42-46
P. F. Sitnikov, "Curvature of the meteor trail of 4 August 1937 from photographic plates. Tomsk state Pedagogic Institute"	47-52
V. G. Fesenkov, "Illumination of the sky during the total eclipse of the sun"	53-55
V. K. Abol'd, "Accuracy of latitude determined for observations of zenith stars and twin stars according to Falcott's Method. Project of special zenith telescope. (submitted 21 Jul 1938)"	56-66
N. Malkin, "Determination of the figure of a geoid on the basis of observations of gravity"	67-72

	pages
N. Malkin, "Derivation of the Serigiana-Clairent formulae with the aid of curvilinear co-ordinates"	73-76
M. N. Pariyskiy, "New attempts to explain the origin of the solar system". Sternberg Astronomical Institute. (submitted 15 Oct 1938)	77-83 84-89
V. G. Pessenkov, "Problem of the origin of the solar system"	
S. A. Zhorygin, "Annotated index of a astronomical literature published in August and September 1938" (submitted 14 Oct 1938)	90-96
Astronomicheskii Zhurnal Vol 16, No 2, 1939	1-16
V. G. Pessenkov, "Problems of the solar eclipse"	
E. Verontsov-Vel'yaminov, "Revised spectrophotometric temperature of Nova Herculis 1934"	17-29
A. S. Yagolim, "Analytical method of determining of meteors" Correspondence School Sector, Moscow University (submitted Apr 1938)	30-36
V. K. Abol'd, "Results of determining the latitude from observations of star beta Draconis and faint zenith stars" (submitted 5 Aug 1938)	37-43
N. Migal', "Choice of the equatorial constant in the normal formula for gravity". Gravimetric observatory, Academy of Science USSR, Poltava	44-46
A. A. Mikhaylov, "Remark on the preceding paper by N. K. Migal' concerning the determination of the equatorial constant in the normal formula for gravity"	47-48

	Pages
D. L. Astavin-Pazumin, "Investigation of tubes of molecular hydrogen" (submitted 5 Jul 1938)	49-55
A. A. Vodar, "Electrical synchronizing systems" (submitted 15 Nov 1938)	56-61 62-63
S. K. Mitra, "Origin of layer E of the ionosphere"	65
M. Budylna, "Autograph [Manuscript] of William Herschel (1738-1822)"	66
M. Vaiskev, "Articles of the astronomical institute and of Ambartsumian concerning the problem of the three points: Sun-Jupiter-Asteroid"	67
V. Ambartsumian, "Correction to the article of V. Ambartsumian"	68-79
G. A. Aristov, "Results of the December session of the astronomy group, academy of science USSR"	80-82
M. Mabekev, "Bibliography"	83-93
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Oct, Nov and Dec 1938" (submitted 1 Feb 1939)	

Astronomicheskii Zhurnal Vol 16, No 3, 1939

G. F. Sitnik, "Results of observations of sunspots with aid of a thermo-integrator". Astronomical observatory, Kuchino.	1-8
B. Vorontsov-Velyaminov, E. Krinov and O. Kramer, "Spectrophotometry of the continuous spectrum of Nova Herculis 1934" (submitted May 1938, Moscow)	9-17
P. V. Kunitskiy, "Improving the accuracy of the determination of spatial star densities"	18-26
M. S. Eygensov "Surface brightness of the night sky and the infinity of the astronomical universe". Pulkovo observatory	27-49

	pages
K. A. Voroshilov, "Orbit and ephemeris of the lyrid shower according to observations in the USSR (1909-1936)". State astronomical institute imeni Shternberg-Movago	50-58
N. N. Sytinskaya, "Color index of one meteor". Astronomical observatory, Leningrad University	59-61
V. G. Shaposhnikov, "Construction of a normal system of declinations on the basis of zenith symmetry of systems obtained from observations" (submitted Dec 1938)	62-74
P. V. Ryazkovskiy, "Increase of sensitivity of photographic plates after treatment with mercury vapors"	75-80
I. N. Golovin, "Sources of stellar energy" Physical institute, Moscow state university	81-99
Chronicle: Astronomical council on the observations for a new catalog of weak stars, 10-12 Nov 1938	100-104
"Reports of observatories and institutes"	105-118
D. Ya. Martynov, "Bibliography". Engel'gard observatory (submitted 8 March 1939)	119-122
S. A. Shorgyin, "Annotated index of astronomical literature published in the USSR during Jan, Feb and Mar 1939"	123-131

Astronomicheskii Zhurnal Vol 16, No 4, 1939

pages

A. B. Severnyy, "Theory of the static solar corona" (submitted
20 Mar 1939, Moscow)

1-17

P. P. Parenago, "Determination of the sun's galactic orbit" Astronomical
Institute Imeni Shternberg, Moscow (submitted May 1939)

18-24

A. I. Zel'manov, "Problem of determining the orbit of visual binaries" 25-30
P. Yu. Levin, "Distribution of meteor heights". State Pedagogic

31-48

Institute Imeni Likhnekh Moscow (submitted 1938)

49-51

V. E. Shtepan, "Angular velocities of telescopic meteors"

M. S. Rygenson, "Dates of maxima and minima of the current cycle of
solar activity". Pulkovo observatory (submitted 17 April 1938)

52-53

V. Nikonov and P. Melikovskiy, "The first Soviet stellar electro-
photometer [photoelectric photometer]"

54-68

N. Moiseyev, "Present status of qualitative celestial mechanics"
"Production of energy in stars". [From the Journal of British

69-86

Astr Ass'n]

87

88-104

"Reports of observatories and institutes"

N. N. Pariyskiy (Secretary of the commission), "Chronicle: Information
bulletin No 1 (commission on preparation for the total solar
eclipse) 21 Sept 1941"

105-106

S. A. Shorygin, "Annotated index of astronomical literature published
in the USSR in Apr and May 1939", (submitted 19 May 1939)

107-112

Astronomicheskii Zhurnal Vol 16, No 5, 1939	pages
P. P. Parenago, "Distribution of visual binary stars according to their periods". Astronomical Institute imeni Shternberg, Moscow (submitted Jun 1939)	1-16
M. N. Livov, "Mass-luminosity Relation"	17-21
M. S. Evgensen, "Methods for investigating the rotation of galaxies (submitted 7 Jul 1938, Pulkovo)"	22-28
V. F. Kalashnikov and B. A. Verontsov-Vel'yaminov, "Definitive curve describing the variation in brightness of nova Lacertae 1910"	29-35
N. Parabashev, "Distribution of brightness in the earth's shadow during the total eclipse of the moon on 7-8 Nov 1938"	36-40
I. N. Fadleva, "Determining the colors of Jupiter and Saturn from photometrical and colorimetrical observations". Astronomical observatory of the Leningrad University	41-50
N. N. Sytinskaya, "Photometer for measuring the brightness of meteor trains". Astronomical observatory of the Leningrad University	51-53
N. Ya. Bygoslavskaya, "Comparative investigation of photographic objective lens from the viewpoint of use in astronomy"	54-65
I. P. Tarasashvili, "Variations in the osculating major semiaxis of the orbit of a comet at a great distance from the solar system"	66-71
I. Yanzhul, "Use of automatic computers [Punch card machines] in astronomical computations"	72-85
Chronicle: Organizational council on the catalog of weak stars, 6-7 Jun 1939	86-87
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Jun-Jul 1939". (submitted 9 Aug 1939, Moscow)	88-96

Astronomicheskii Zhurnal Vol 16, No 6, 1939	pages
B. K. Vakhnavyatskiy, "A century of the main astronomical observatory USSR"	1-6
P. P. Parenago, "Generalized mass-luminosity relation". (submitted Jul-Sept 1939, Moscow)	7-14
I. S. Astapovich, "Results of the investigations of the orbits of 66 meteorites" (submitted Feb 1938)	15-15
V. A. Voroshilov, "Determining the type of tail of the comet 1937 (Finster). Astronomical Institute Imeni Shternberg (submitted Jun 1939, Moscow)	16-17
A. Il'inich, "Eliminating the brightness equation in photographic and visual position observations" (submitted 18 Dec 1938, Bul'kovo)	50-51
A. A. Orlova, "Jacobi's solution to the three-body problem with variable mass" (submitted 1 Dec 1938, Moscow)	52-56
V. Fesenkov, "Outer atmosphere"	57-62
V. Fesenkov, "Hydrogen content of white dwarf stars in relation to the problem of stellar evolution"	63-68
N. Florya, "Absorption of light, and distribution of stellar density in galaxies"	69-75
Dzh. Gort, "Progress of stellar astronomy"	89-91
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Aug-Sept 1939" (submitted 8 Oct 1939, Moscow)	92-99

- END OF VOLUME XVI (1939) -

Astronomicheskii Zhurnal Vol 17, No 1, 1940	pages
P. N. Dolgov, "Aleksandr Aleksandrovich Ivanov"	1-3
S. V. Orlov, "Meteoric streams and comets", (submitted August 1939)	4-7
S. V. Orlov, "Unusual comets: I. comet 1892 III"	8-12
S. V. Kukarkin, "Selective and total light absorption in the plane of the Milky Way". Institute imeni Sternberg, Moscow (submitted Oct 1939)	13-18
S. V. Kukarkin, "The nature of light absorption in the galactic plane" Institute imeni Sternberg, Moscow (submitted Oct 1939)	19-24
V. G. Fesenkov, "Problem of zodiacal light"	25-28
N. A. Vorontsov-Vel'yaminov, "Possibility of testing the expansion theory of novae by the absorption line contours" [In English]	29-35
N. A. Vorontsov-Vel'yaminov and M. S. Murasheva, "Comparison of the influence of developers on the size of the grain and the characteristic curve of photoemulsion"	36-38
A. V. Putsikhvanidze, "Calculation of the area ratio: 'elliptic sector' / 'corresponding triangle' [In orbits]" Kutaisi Pedagogic Institute	39-42
A. A. Mikhaylov, "Application of Stokes formula for determining the figure of the geoid"	43-52
K. P. Mustel', "Reporting the work of the 12th, 13th, and 14th committees, VI Congress of International Astronomical Association"	53-61
D. Menzel, "Chromosphere and corona" [translation from English, in trans Intern'l Astr Union]	62-65
Eupert Wildt, "Electron affinity in astrophysics" [translation from English]	66-70

	pages
H. N. Russell, "Stellar energy" [translated from Proc of Am Phil Soc and J of Roy Astr Soc of Canada]	71-76
A. Danzhon and A. Kude, "Atmospheric disturbance"	77-89
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Oct-Nov 1939"	90-95
Astronomicheskii Zhurnal Vol 17, No 2, 1940	1-11
K. N. Shistovskiy, "Moscow planetarium after ten years"	
E. R. Mustel', "Radiative equilibrium of the atmospheres of hot stars" [in English]. Astronomical Institute Imeni Sternberg (submitted Jan 1940)	12-40
V. G. Vesenkov, "Luminosity of the night sky and zodiacal light" (submitted 31 Jan 1940, Moscow)	41-50
P. P. Parenago, "The relations 'period-luminosity' and period-mean density' among cepheids". (submitted Dec 1939, Moscow)	51-54
V. A. Yelistratov, "New method for determining the flexure of astronomical instruments" Pulkovo observatory (submitted Mar 1938)	55-60
I. I. Putilin, "Improved orbit of the asteroid 274 Philagoria" (submitted 24 May 1939, Kiev)	61-66
B. V. Kukarkin, "Classification of variable stars" Institute Imeni Shternberg (submitted Feb 1940, Moscow)	67-69
Chronicle: VII All-Union Conference on variable stars	70-85
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Dec 1939 and Jan 1940" (submitted 17 Feb 1940, Moscow)	86-96

Astronomicheskii Zhurnal Vol 17, No 3, 1940	pages
V. G. Fesenkov, "Astronomy and culture"	1-11
B. Yu. Levin, "Elements of the physical theory of meteors"	12-11
[with long English-language abstract] State Pedagogic Institute imeni Likhnekht (submitted 1938/39, Moscow)	
V. Krat, "Ellipticity of close binaries" (submitted Feb 1940, Pulkovo)	12-14
G. P. Kramer, "Preliminary results of examination of astroclimate of Central Asia"	15-19
L. N. Sachirzhetskiy, "Changes in the latitude of Kitab for the period 1937.0-1939.0" Kitab, latitude observatory (submitted Mar 1940)	50-51
A. I. Oparin, "Origin of life on the earth"	52-65
"Reports of astronomical institutions"	66-97
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Feb-Mar 1940"	98-101

Astronomicheskii Zhurnal Vol. 17, No 4, 1940	
F. P. Parenago, "Dark nebulae and the galactic absorption of light"	
Astronomical Institute imeni Sternberg (submitted Apr 1940, Moscow)	1-22
G. F. Sitnik, "Dependence of the intensity of sunspots on their position on the disk and their geometric area" [In English] Astrophysical observatory of Moscow University, Kuchino	23-29
L. N. Radlova, "Visual photometry and colorimetry of Mars during the time of opposition in 1939" Astronomical observatory Leningrad State University 1940	30-36

	pages
V. V. Sharenov, "Photographic observations of Mars at the time of opposition of 1939" Pulkovo Observatory	37-39
Ye. L. Krinov, "Spectrophotometric study of 40 stony meteorites" Committee on Meteorites, Academy of sciences USSR, Moscow	40-67
G. A. Tikhov, "Standardization of photographic observations of the corona, obtained from tube photometry"	68-73
A. V. Merkulov, "Note concerning the article by N. Parabasheva: 'Distribution of brightness in the terrestrial umbra during the total lunar eclipse of 7-8 Nov 1938' (submitted 7 Jan 1940) Tashkent	74-75
Prof. D. Ya. Martynov, Director of Astronomical observatory imeni Engel'gardt "Report of the activities of the Engel'gardt astronomical observatory affiliated with Kazan state University, 1939"	76-77
Chronicle: All-Union Gravimetric Council	78-87
V. Shtepan, "Bibliography (Reviews)". Saratov University (submitted 17 Apr 1940)	88
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Apr-May 1940". (submitted 1 Jun 1940, Moscow)	89-96
Astronomicheskii Zhurnal Vol 17, No 5, 1940	
V. V. Gerdyn'tsev, "Theory of stellar nuclei. Part I. Forms of existence of nuclear matter". Radium Institute, Academy of Science USSR	1-25
M. S. Eygenson and O. V. Dobrovolskiy, "Cosmic absorption at different galactic longitudes"	26-31

	pages
I. S. Astapovich and V. V. Fedynskiy, "Gaseous trains of two fireballs of 11-12 Aug 1937". (submitted 1939, Moscow)	32-43
M. Barabashev and I. Timoshenko, "Photographic photometry of Mars in red and blue rays"	44-53
M. S. Zverev, "Catalog of faint stars". Astronomical Institute Leningrad (submitted May 1940, Moscow)	54-78
M. Ye. Nabokov, "Memograph for computing the distance non-distorted by absorption". (submitted 24 Feb 1940)	79-80
Kuper wildt, "The nature of plants". [From Proc of Amer Phil Soc]	81-88
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR in Jun-Jul 1940". (submitted 29 Aug 1940, Moscow)	89-96

Astronomicheskii Zhurnal Vol 17, No 6, 1940

M. Bobrov, "Physical interpretation of the phase curve of Saturn's rings". (submitted Sept 1939)	1-8
M. S. Eygenson and M. I. Levitskiy, "Impulse of solar activity in Wolf numbers and allied characteristics"	9-12
M. S. Eygenson, "Connection between some characteristics of solar-activity impulses and the 11-year cycle". Pulkovo observatory Dept of solar service	13-16
M. S. Eygenson and B. M. Rubashev, "Problem concerning the synchronism of appearance of solar-activity impulses"	17-20
F. N. Felitsyn, "Prominences and geomagnetic activity". Pulkovo observatory Dept of solar service	21-25
V. M. Gavrilova, "Geomagnetic disturbances and solar-activity impulses" Pulkovo observatory Dept of solar service	26-32

CONFIDENTIAL

pages

- T. V. Vedop'yanova, "Results of investigations of 125 comet orbits regarding their mutual intersection". Astronomical Institute imeni Shternberg (submitted 16 Feb 1940) 33-56
- K. A. Voroshilov, "Determining the type of tail of the comet 1639d (Jurlof-Achmarof-Hassel)" [in English] Astronomical Institute imeni Shternberg (submitted Jun 1940) 57-60
- V. A. Fass, "Radial velocities of class-B stars" (submitted 14 Apr 1940) 61-64
- S. S. Petrov, "System 44 1 Bootis". (submitted Jan 1949, Leningrad) 65-78
- S. A. Shorvain, "Annotated index of astronomical literature published in the USSR Aug-Sep 1940". (Submitted 14 Oct 1940, Moscow) 79-88

- END OF VOLUME XVII (1940) -

Astronomicheskiy Zhurnal Vol 18, No 1, 1941

- V. V. Gherdyntsev, "Theory of stellar nuclei. Part III. Abundance and age of atomic nuclei". Radium Institute, Academy of Science, USSR 1-9

[Note: Part II appears only as an English-language abstract here.]

- A. I. Lebedinskiy, "Rotation of the Sun". Astronomical observatory Leningrad State University (submitted Jun 1940) 10-25
- R. S. Gherysheva, "Vortical motion in the solar photosphere" Pulkovo observatory Dept of solar service 26-30
- V. G. Pesenkov, "Investigation of zodiacal light from observations in the tropics" 31-34

- 13 -

CONFIDENTIAL

	pages
M. F. Subiotin, "Computation of secular disturbances". Astronomical observatory, Leningrad University	35-40
V. G. Shaposhnikov, "Possible method of absolute determination of declinations"	51-55
A. A. Il'inich, "Referring a star catalog to extra-galactic nebulae" Pulkovo	56-57
I. S. Astapovich, "Some problems concerning the origin of meteoric matter"	58-72
"Physical characteristics of Wolf-Rayet type stars and their relation to other objects of earlier types"	73-77
V. Resenkov, "McDonald Astrophysical observatory in Texas"	77-79
N. Pavlov, "Use of photocells in determining stellar positions and correction of clocks"	80-82
Chronicle:	83-93
S. A. Shorygin, "Annotated index of astronomical literature published in USSR in Oct-Nov 1940" (submitted 1 Dec 1940, Moscow)	94-102
<u>Note: Issue numbers 2 and 3 are missing.</u>	*

Astronomicheskii Zhurnal Vol 18, Nos 4-5, 1941

E. F. Mustel', "Distribution of energy in the continuous spectrum of stars of early classes". State astronomical institute imeni Shternberg (submitted Feb 1941, Moscow)

297-311

* Note: Pages 103 to 296, corresponding to issues numbered 2 and 3, are missing.

CONFIDENTIAL

pages

A. M. Lebedinskiy and S. S. Zhuravlev, "Photoelectric photometer for Sun's surface"	317-330
P. Yu. Levin, "Elements of the physical theory of meteors. II" State Pedagogic Institute imeni Libknekht (submitted 1940/41, Moscow)	331-342
A. A. Batyrev, "Shape of trajectories in the problems of two and three bodies with masses varying according to Meshcherskiy's law"	343-346
H. Malkin, "Generalization of Stokes' formula"	347-349
K. A. Kulikov, "Determining the latitude and time by reflecting zenith tubes". State astronomical institute imeni Shternberg, Moscow	350-365
Chronicle: Reports of astronomical institutions in the USSR	366-381
Criticism and Bibliography. Review	382-388
S. A. Shorygin, "Annotated index of astronomical literature published in the USSR Apr-May 1941". (submitted 19 Jun 1941, Moscow)	389-398

Note: Issue number 6 is missing.

- END OF VOLUME XVIII (1941)

Astronomicheskii Zhurnal Vol 19, No 1, 1942

V. V. Sheronov, "Brightness and color of the solar corona during the eclipse of 21 Sep 1941". Kazan Affiliate of Leningrad University, Yelabuga	1-8
Ye. L. Krinov and N. N. Sytinskaya, "Brightness distribution in the Solar corona in the infra-red". State Natural-Science Institute imeni P. F. Lesgaft; Astronomical observatory of Leningrad University	9-13

- 15 -

CONFIDENTIAL

CONFIDENTIAL

A. D. Dubyago, "Some problems on the movement, structure, and disintegration of comets". Kazan State University (submitted Nov 1941)

pages

11-16

Astronomicheskii Zhurnal Vol 19, Nos 2-3, 1942

A. D. Dubyago, "Some problems of the movement, structure and disintegration of comets". Kazan State University (submitted Nov 1941) 49-62

P. Ya. Martynov, "Fine effects of eclipsing variables". Engelhardt observatory (submitted ear 1941) 63-79

N. G. Odintsov, "Effect of reflection eclipsing variables". 80-106

I. A. Dyukov, "Problem concerning the influence of flexure of meridian circle and zenith-telescope on the results of observations by the Sanders-Faymond method" 107-112

Chronicle: Reports of astronomical institutions in the USSR 113-119

Astronomicheskii Zhurnal Vol 19, No 4, 1942

V. Resenkov, "P. P. Lazarev [deceased]" 1-2

M. I. Idel'son, "P. F. Rents (Feb 1859-Jan 1942)" 3-4

(submitted 1941, Kazan) 5-6

N. I. Idel'son, "V. R. Berg [deceased]" 7

I. A. Dyukov, "V. A. Baranov [deceased]"

N. I. Chudovichev, and K. V. Kostylev, "Determining the brightness of the corona and its separate zones during the total Solar eclipse of 21 Sept 1941" 8-14

- 16 -

CONFIDENTIAL

CONFIDENTIAL

	pages
Ye. Ya. Bugoslavskaya, "Dependence of coronal forms upon formations at the Sun's surface and in the chromosphere, according to the observational data of 21 Sep 1941"	15-18
V. P. Litvinov, "Measurement of the density of light ions and condensation nuclei in the atmosphere at Alma-Ata during the total solar eclipse of 21 Sep 1941"	19-23
G. Mezhar, "Variations in meteorological elements during total Solar eclipse"	24-27
V. G. Fesenkov, "Dynamic theory of zodiacal light". Institute of astronomy and physics, Alma-Ata	28-49
A. A. Nefed'yev, "Determining the diameters of Venus and Jupiter [in degrees]"	50-60
P. N. Chirvinskiy, "Accumulation of cosmic dust"	61-63
Reference and Review - "News of Astronomy: "New value for the Sun's parallax"; "At the Greenwich Observatory"; "Problem of energy production in red giants" [From Phys Review]; "New tables of wavelengths [MTT]"	64-68

Astronomicheskii Zhurnal Vol 19, No 5, 1942

V. G. Fesenkov, "Progress of astronomy in the USSR during the last 25 years". (submitted 15 Oct 1942) Alma-Ata	1-17
E. A. Vorontsov-Vel'yaminov, "Tercentenary of Newton's birth"	18-24
M. M. Markovich, "Galileo (1642-1942)"	25-29

CONFIDENTIAL

CONFIDENTIAL

	pages
Ye. Ya. Bugoslavskaya, "Dependence of coronal forms upon formations at the Sun's surface and in the chromosphere, according to the observational data of 21 Sep 1941"	15-18
V. F. Litvinov, "Measurement of the density of light ions and condensation nuclei in the atmosphere at Alma-Ata during the total solar eclipse of 21 Sep 1941"	19-23
G. Mozhar, "Variations in meteorological elements during total Solar eclipse"	24-27
V. G. Fesenkov, "Dynamic theory of zodiacal light". Institute of astronomy and physics, Alma-Ata	28-49
A. A. Nefed'yev, "Determining the diameters of Venus and Jupiter [in degrees]"	50-60
P. N. Chirvinskiy, "Accumulation of cosmic dust"	61-63
Reference and Review - "News of Astronomy":	64-68
"New value for the Sun's parallax"; "At the Greenwich Observatory";	
"Problem of energy production in red giants" [from Phys Review];	
"New tables of wavelengths [MIT]"	

Astronomicheskii Zhurnal Vol 19, No 5, 1942

V. G. Fesenkov, "Progress of astronomy in the USSR during the last 25 years". (submitted 15 Oct 1942) Alma-Ata	1-17
B. A. Vorontsov-Vel'yaminov, "Tercentenary of Newton's birth"	18-24
M. M. Markovich, "Galileo (1642-1942)"	25-29

CONFIDENTIAL

CONFIDENTIAL

pages

V. A. Ambartsumian, "Diffusion of light by the atmospheres of planets". Astronomical observatory, Leningrad University
(submitted Dec 1941-Jan 1942)

30-41

Reports of scientific activities of the astronomical institutions
of the USSR [Ybastuman, Tashkent, Stalinabad, Kazan, State]

Astronomicheskiy Zhurnal Vol 19, No 6, 1942

A. A. Mikhaylov, "Observation of Einstein's results during the Solar
eclipse of 19 Jun 1936"

1-17

V. Krat, "Some problems on the theory of light scattering in the
earth's atmosphere". (submitted 28 Jan 1942, Alma-Ata)

18-29

M. D. Lavrova, "Photographic comparison of light sources in a wide
range of brightness". (submitted 15 Sep 1942)

30-33

I. A. Tikhov, "Photographic photometry without objective lenses"
Astronomical observatory, Alma-Ata (submitted Aug 1942)

34-37

V. V. Sharonov, "Calculating the beginning, end and duration of twilight
taking into account cloudiness". Branch of Leningrad State
University, Yelabuga

38-42

V. G. Fesenko, "Structural forms of the solar corona of 21 Sep 1941"

43-49

V. G. Fesenko, "Matter in interstellar space"

50-52

- END OF VOLUME XIX (1942) -

- E N D -

- 18 -

CONFIDENTIAL

CONFIDENTIAL

C I A

FOREIGN DOCUMENTS DIVISION

23 Oct 1951

50X1-HUM

50X1-HUM

Generalized Hydrographs for the Determination of
Gidrotekhnicheskoye Stroitel'stvo, No 8, 16-19, Professor
A. V. Ogiyevskiy, August 1947.

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

Charts and Figures are appended.

GENERALIZED HYDROGRAPHS FOR THE DETERMINATION OF FLOOD DIAGRAMS

Professor A. V. Ogiyevskiy,
Doctor of Technical Sciences.

The diagram of a rain flood or spring flood is usually introduced into ~~the~~ computations as the graph of inflow, taking into consideration the regulating effect of the reservoir on the magnitude of the maximum computed discharge.

Engineer D. I. Kocherlin has proposed to utilize, for the plotting of inflow graphs, the simplest schematization figures, namely the triangle and the trapezium, and also Pearson's distribution curves of the type III or V. On using such a method of primary characteristics - maximum discharge Q_m and total flood run-off $\sum Q$ are readily tied up with the configuration of the inflow graph, if one assumes some definite correlations between values of t_1 and t_3 - the durations of rise and recession, and in the case of the trapezium if it is assumed that duration of sustained maximum t_2 constitutes some portion of the total flood duration T . Plotting on the basis of triangle and trapezium is very simple and in the final computations the errors resulting from the use of such simplified schematization of the hydrographs (in lieu of the more complex curvilinear contour) are generally less than the inaccuracies of approximate determination of the initial characteristics Q_m , $\sum Q$, and correlations of t_1 and t_3 . Plotting of the hydrograph by means of Pearson's distribution curves is more complicated, but in this case also the values Q_m and $\sum Q$ are determinative.

In order to approximate more closely the shape of computed inflow graphs to the frequently observed curvilinear contours, a number of new investigations has been recently conducted.

- 1 - CONFIDENTIAL

CONFIDENTIAL

Engineer S. I. Rybkin (literature 1) published, in 1940, monographs which greatly facilitate the plotting of curvilinear hydrographs corresponding to Pearson's distribution curves of type III and V, when only the values of Q_m , $\sum Q$ and t_1 are known.

Professor D. L. Sokolovskiy and S. N. Bogolyubov (literature 2) and (literature 3) propose to express the slopes of rise and recession as concave parabolas of different order. In the computation, Q_m , t_1 and t_3 are used as the initial data.

In 1946, engineer K. Ya. Kozhanov (literature 4) proposed, in view of the pronounced deviations from factuality inherent in the method of D. L. Sokolovskiy, to express the slopes of rise and recession as hyperbolic curves corresponding to equations of relatively simple form. Computation is based on the same initial data used in the foregoing method with the difference, however, that the constant coefficients of the equations employed have not been standardized by K. Ya. Kozhanov, and, as can be seen from the examples given by him, fluctuate within fairly wide limits.

The two last-named proposals, in addition to their specific shortcomings, which are inherent in the characteristics of the adopted curves (concavity of the parabolas of D. L. Sokolovskiy and S. N. Bogolyubov), have one substantial defect in common. The determinant characteristic of the computed inflow graph, namely the volume of runoff $\sum Q$, is not an initial argument, but is determined on the basis of assumed values of T , t_1 and t_3 ; any determination of these values being, in general, only approximate.

Our preliminary computations have shown, for instance, that, in addition to various discrepancies between the shape of computed and actual runoff hydrographs, computations by the method of D. L.

- 2 -
CONFIDENTIAL

CONFIDENTIAL

Sokolovskiy may result in the case of a vernal flood in a two- to threefold magnification of the runoff volume, while in the case of a rain flood the results obtained are substantially less than the actual total runoff. The shape of the hydrograph in these instances thus substantially distorts the volume of the total runoff. At the same time it must be pointed out that the number of possible combinations of natural conditions, which determine the type and shape of flood runoff hydrographs, is very great. As we have shown previously (literature 5) the type of flood hydrographs, in the case of small basins where the duration of longitudinal run up t_k is less than the duration of run-off t_c , is determined essentially by the nature of the run-off, i.e. by conditions of rainfall or snow melting, and is the more pronounced with decreasing value of t_k with respect to t_c .

In the case of larger basins with $t_k > t_c$ the type of the flood hydrograph is determined to an appreciable extent by the location, in relation to the estimated line of direction of the area of maximum formation, i.e., the portions of basin with greatest width, and also by the degree of regulatory effect of river bed capacity.

Insofar as vernal floods are concerned, the nature of the basin may not be a determinant factor, since its effect may be offset by the nature of delivery (run-off due to melting of snow). Under such conditions, any attempt at generalization in solving the problem, by means of parabolas or hyperbolas and any constant parameters, is, generally speaking, of doubtful effectiveness.

For that very reason D. L. Sokolovskiy and S. M. Bogoliyubov have limited the scope of their investigations to selected hydrographs of regular shape with rises of drastic intensity, independent of the magnitude of maximum discharge (having unfortunately designated these

- 3 -
CONFIDENTIAL

CONFIDENTIAL

selected hydrographs as "derived").

In the recently published work of Commons (literature 6) an example is given of an interesting method of hydrograph generalization, which makes possible its utilization in computations involving basins varying greatly in size.

Essentially on the basis of this method, a very simple and effective procedure can be proposed for preparation of computed flood hydrographs of any shape, which most accurately reproduce the actual conditions.

If the compilation of actual data is suitably generalized, a most versatile pattern is obtained which encompasses a wide gamut of eventualities in respect to flood durations and their maximum discharges.

Let us consider a hydrograph (figure 1) of flood runoff, plotted with the following coordinates. Axis of ordinates in percent of maximum discharge Q_m of this flood; axis of abscissa in percent of its duration (in lieu of percentages any other conventional scale can be used). Let us assume that, measured in the conventional units used, the area of such a general hydrograph is equal to n conventional units.

Let us assume the following initial data: computed maximum discharge Q_m m³/sec of given probability ~~assumed constant~~ Q_m cubic meters/second; ~~total~~ ^{total} flood runoff set as certain A , millimeters (or ΣQ cubic meters).

For ~~the~~ conversion from the general hydrograph to an actual, ^{one} it is sufficient to determine the corresponding scale for the axis of ordinates and axis of abscissae.

The value of scale unit ~~of~~ runoff y for the axis of ordinates is readily determinable, on the basis of the adopted designations, from the correlation:

CONFIDENTIAL

CONFIDENTIAL

$$y = \frac{Q_m}{100} \text{ m}^3/\text{second} \quad (1)$$

We then determine the numerical value of area w , in the hydrograph to be plotted, corresponding to each surface unit of the general hydrograph. ~~The area of the hydrograph to be plotted, corresponding to each surface unit of the general hydrograph.~~ The area of the hydrograph to be plotted (m^3) is equal to $A.F. \cdot 10^3$, where F is the area of the basin (in square kilometers), or this area is equal to ΣQ_m^3 . [sic]

Therefore

$$w = \frac{A.F. \cdot 10^3}{n} = \frac{\Sigma Q}{n} \text{ m}^3 \quad [sic] \quad (2)$$

from (2), if the scale of runoff unit is known, it is not difficult to determine the scale of time unit X for the axis of abscissae :

$$X = \frac{w}{y} = \frac{A.F. \cdot 10^3}{y \cdot n \cdot 100} = \frac{\Sigma Q}{n \cdot y \cdot 100} \text{ 24 hours} \quad (3)$$

that is,

$$X = \frac{1.16 A.F.}{n Q_m} = \frac{0.00116 \Sigma Q}{n Q_m} \text{ 24 hours} \quad (4)$$

Scale of discharge and of time being known it is not difficult to pass from the configuration of figure 1 to an actual hydrograph, and in so doing we can simplify the calculations without detracting from their accuracy, by plotting the ordinates of the flood hydrograph at 5 percent, or even at 10 percent intervals of time values.

It is thus apparent that in this case the total duration of the flood, as well as values t_1 and t_3 , are obtained automatically in accordance with the adopted shape of the flood hydrograph and in full accordance with the values Q_m and ΣQ , with any contour of the slopes of rise and recession.

CONFIDENTIAL

CONFIDENTIAL

A series of studies made by us has shown that in this method of generalization hydrographs are conveniently plotted by previously subtracting the base (ground) flow q_0 . In doing so, for any given point it is convenient to adopt a constant value for q_0 , equal for instance to the greatest possible value of base (ground) flow. Then in lieu of the observed hydrograph ordinates Q_i there are introduced values $Q_i - q_0$ including $Q_m - q_0$.

Any curvilinear shape of flood hydrograph can be obtained on prior execution of a set of hydrographs with the given correlation ratio $t_1:t_2$ (for example 1:1; 1:1.5; 1:2; 1:3; 1:4), insofar as these ratios are basic with respect to the position of the hydrograph peak. To simplify computation suitable tables can be prepared wherein are given as basic constants the values of n for various types of generalized hydrographs, that is, values of their areas expressed in conventional units (which can be done by means of a planimeter).

The generalized hydrograph shown in figure 1 of the spring run off, was prepared from the hydrographs of the River Sozh at Gomel. It was found that it fits sufficiently well also other basins of the River Dnepr system. In figure 2 the thin lines represent the calculated, theoretical hydrographs, computed on the basis of the generalized hydrograph of figure 1, of the spring run-off for the River Pripyat at Mozyr (1917), and the River Sozha at Propolisk (1917) and for the River Desna at Bryansk (1917). The initial data used in the plotting are given in Table 1.

In figure 2 are shown in heavy lines the observed hydrographs of spring run-offs corresponding fairly well to those calculated, despite very material differences in the magnitude of maximum discharge and of the total duration of the flood. It is thus apparent that the

CONFIDENTIAL

CONFIDENTIAL

calculated and the actual hydrographs tally very well. Even in the case of the River Pripyat at Mozyr, which is exceptionally outstanding in its hydrographic characteristics, the theoretically derived diagram of the hydrograph, if it is shifted to the left in the drawing, follows almost in its entirety the theoretically computed diagram [sic]. Thus, a single general hydrograph is sufficiently well adapted for various basins with a surface from 12410 to 100300 square kilometers, at a maximum discharge from 559 to 4,928 cubic meters per second and with a flood duration range within the limits of 26-57 days.

The variation limits of the configuration of spring (and rain) run-off hydrographs are very wide even insofar as conditions at a single point are concerned. They are determined, as previously stated, by actual variations in the process of snow melting during the spring, which can impart various values to $t_1:t_3$. Some of the results obtained on studying the typology of spring run-off hydrographs of the River Pripyat at Mozyr are shown in figure 3. The corresponding characteristic data are given in Table 2.

As can be seen, to the greatest maxima corresponds a ratio $t_1:t_3$ of about 1:3 - 1:4; while ratios of about 1:2.0 - 1:2.5 correspond to the lowest maxima. It must be kept in mind that in the computation of maximum discharges, the most closely approximating results are obtained with ratios $t_1:t_3$, providing for the lowest values of t_3 , i.e. with hydrographs with the greatest of the possible t_1 values, and also with the most elongated peak. Therefore, of the available range of variations for the ratio $t_1:t_3$, one should take as the calculation basis those wherein t_3 has the lowest value, the selection being made from among ratios corresponding to the highest maxima observed.

Consequently in the instance corresponding to figure 3, the

CONFIDENTIAL

CONFIDENTIAL

calculation of outstanding maxima should be based on the general hydrograph of 1895 (or of 1883 as having the most elongated peak).

The proposed procedure for a graphic (or tabular) generalization of curvilinear shapes of hydrographs of spring and rain run-offs, while being most universally adaptable, is also very simple and is free of the requirement to adhere rigidly to preconceived models in the plotting.

A comprehensive set of developed general hydrographs, characteristic for rivers of different types and of different physico-geographic zones, can be readily prepared by proper selective treatment of their hydrographs of outstanding maxima.

Finally, it should be noted that a general hydrograph may be a good starting model for developing polymodal flood conditions under complex formation circumstances in mountain and semi-mountain streams as, for example, those discussed in the recently published work of K. P. Voskresenskiy (literature 7). Having made the typification of such a hydrograph, it is not difficult to obtain any developed hydrograph without resorting to laborious and tedious statistical computations in order to deduce the characteristics of separate features of a complex hydrograph.

CONFIDENTIAL

CONFIDENTIAL

LITERATURE CITED

1. S. I. Rybkin, "Monographs for the Computation of Curvilinear Contour Inflow" Gidrotekhnicheskoye stroitel'stvo, No 7, 1940.
2. S. N. Bogolyubov, "Methods for the Derivation of Snow Flood Hydrographs" Trudy NIU GUMIS, SSSR, Series IV, Issue 39. Water Supply and Flow, Gidrometeoizdat, Leningrad-Moscow 1946.
3. D. L. Sokolovskiy, "Hydrological Computations in the Construction of Bridge Crossings" Ibid, Series IV, Issue 22, 1945.
4. Engineer K. Ya. Kozhanov, "On the Problem of Spring Flood Computations" Gidrotekhnicheskoye stroitel'stvo, No 2, 1946.
5. A. V. Ogryevskiy, "Basic Principles of Runoff Process Within River Basins" Trudy NIU, GUMIS, SSSR, Series IV, Issue 13, 1945.
6. G. G. Gerasimov, "Flood Hydrograph" Civil Engineer, Vol 12, No 10, October 1942, pp. 571-572.
7. K. P. Voskresenskiy, "Fundamentals of Derivation of Mountain River Hydrographs" Meteorology and Hydrology, No 1, 1947.

CONFIDENTIAL

FIGURE LEGENDS

FIGURE 1: Diagram of a general vernal hydrograph.

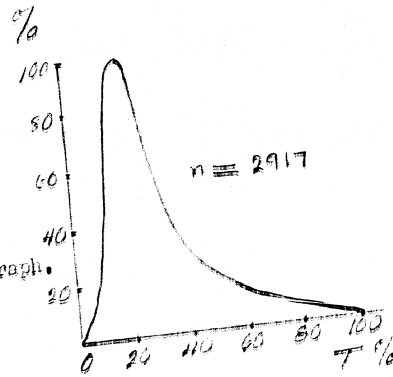


FIGURE 2:

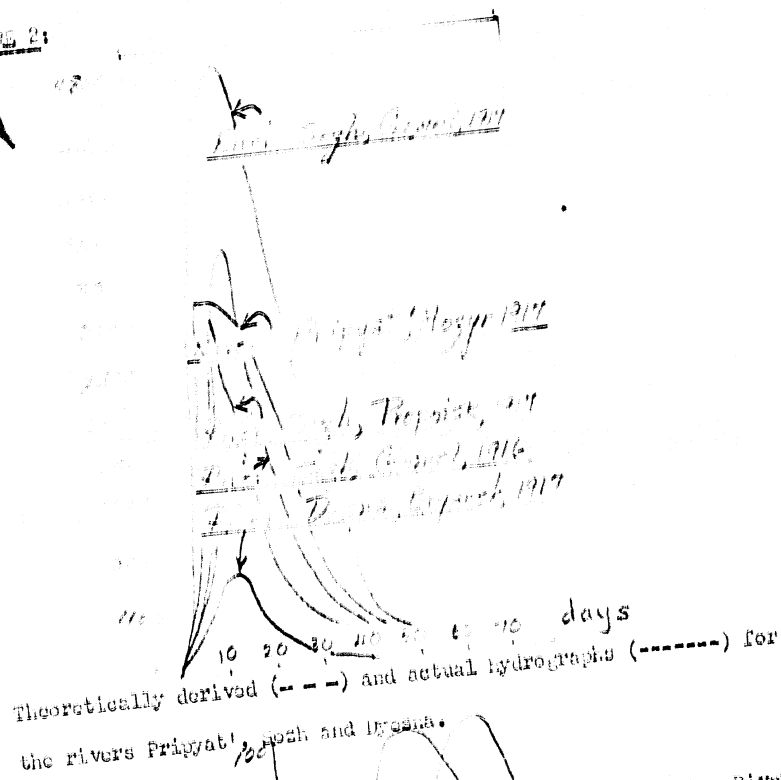
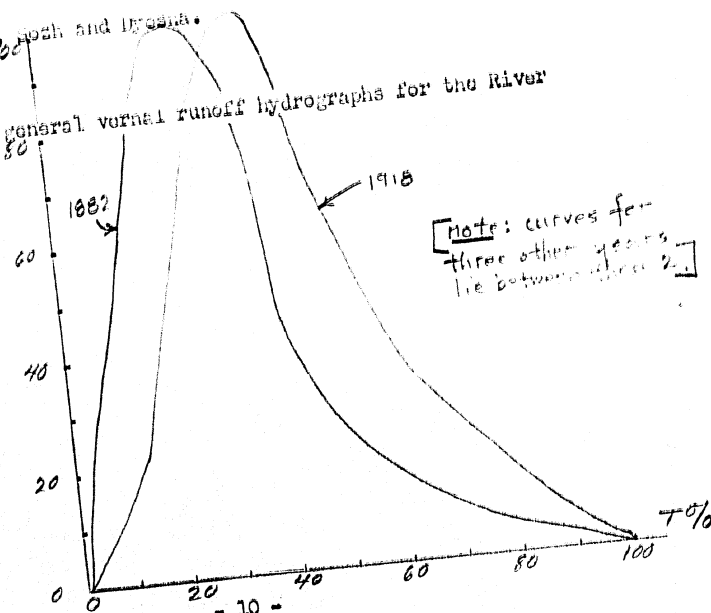


FIGURE 3: Types of general vernal runoff hydrographs for the River Pripyat' at Mozyr.

**CONFIDENTIAL**

CONFIDENTIAL

TABLE 2

<u>Year</u>	<u>Qm, cubic meters per second</u>	<u>γ, in days</u>	<u>$t_1:t_2$</u>
		63	1:4, 15
1883	3,035	57	1:4, 2
1917	3,191	64	1:3
1895	5,930	60	1:3
1946	1,874	52	1:2, 5
1926	2,502	65	1:1, 7
1918	1,456		

NOTE: $q_0 = 400$ cubic meters per second is used for all hydrographs.

CONFIDENTIAL

TABLE 1

River (locality)	Year	Area of Basin in square km	Length up to the Estimated Line of Direction in Kilometers	q_0 m ³ /seconds	$(q_t - q_0)$	$Q_n - q_0$	T	t_1	t_3	$t_1^{*t_3}$
Pripyat' (Mozyr)	1917	100,300	450	100	65,927	2,791	57	11	46	1:4,2
Sozh (Gomel)	1917	38,860	544	200	72,687	1,528	51	10	41	1:4,1
Sozh (Gomel)	1916	38,860	544	200	46,375	3,511	49	10	31	1:3,1
Sozh (Propoisk)	1917	17,660	352	100	32,777	3,290	32	7	25	1:3,6
Desna (Bryansk)	1917	12,410	370	100	5,417	559	26	7	19	1:2,7

CONFIDENTIAL

END
CONFIDENTIAL

CONFIDENTIAL

original 10

C I A

FOREIGN DOCUMENTS DIVISION



22
29 Oct 1951

50X1-HUM

Review of O. K. Lange's Work 'Zonal Distribution of
Ground Waters in the Territories of the USSR'

Izvestiya Vsesoyuznogo Geograficheskogo
Obshchestva, Volume 79, No 6, page 666, Nov/Dec 1947, Moscow

[This report has not been edited or prepared for publication].

CONFIDENTIAL

Proj: 10059

CONFIDENTIAL

REVIEW OF O. K. LANGE'S WORK 'ZONAL DISTRIBUTION OF
GROUND WATERS IN TERRITORIES OF THE USSR'

[Note: The following review appeared in the regular Book review section of the bimonthly journal *Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva* (News of All-Union Geographical Society), Volume 79, No. 6, Nov/Dec 1947, page 666. The original work by Lange appeared in the series entitled *Ocherki po Regional'noy Gidrologii SSSR* (Synoptic Outlines of Regional Hydrology in the USSR), No. 8 (12), Moscow, 1947).

The review was signed V. K., which may be the initials of V. N. Kunin or V. V. Kavrayskiy, who are soviet hydrologists.]

[Complete Translation]

This work is of considerable interest to physical geographers and many naturalists.

The author formulates his propositions, of a general nature, in the terminology used in describing underground waters, and expounds his concepts on principles of hydrogeological partitions, delimitation of a hydrogeological district, area, etc. In this respect the author expands his prior, widely known work.

Irrespective of whether or not all of the author's premises are acceptable, they are all advantageously characterized by definiteness and precise definitions which leave little room for divergent interpretations. The author

- 1 -

CONFIDENTIAL

CONFIDENTIAL

also develops further and in more detail the principles of delimitation of subsurface waters, especially ground waters (the latter being of greatest interest to the geographer), on the basis of the classic postulates of V. V. Dokucheyev relative to zonation, which were extended by P. V. Ototskiy and V. S. Il'in to the case of ground waters.

Defining more specifically, on the basis of recent data, Il'in's well-known district delimitation of the European part of the USSR, the author proceeds beyond the very important boundary line of the Urals and attempts to apply his general propositions to the Asiatic part of the USSR, thereby deducing that the zonality established for the European area cannot be simply transposed to the great plains of Soviet Asia and, on the other hand, that the relatively detailed partition which is possible in Europe is not attainable in Asia.

Of particular interest is the division of Middle Asia into districts of which the author is an outstanding authority; within that region the subject of ground waters is also dealt with to a relatively full extent.

To our knowledge this work is the first of its kind embracing the entire territory of our vast USSR. Within the compass of a brief volume (64 pages) despite succinct presentation, schematization is unavoidable, and in the case of many areas is induced by the paucity of data. To a certain extent, the work indirectly evaluates also the amount of knowledge available on the territory involved. It would be desirable to have in such a publication more and better executed maps. This most interesting synopsis would be considerably enhanced by the inclusion of a list of the original works utilized by the author.

- E N D -

- 2 -

CONFIDENTIAL

50X1-HUM

C I A

FOREIGN DOCUMENTS DIVISION

24 Oct 1951

50X1-HUM

IMPOSES SENTENCES ON 741 COUNTERREVOLUTIONARIES AT HANGCHOW

**Chekiang Jih-pao, Hankow China
15 Jul 1951**

[This report has not been edited or prepared for publication]

CONFIDENTIAL

IMPOSES SENTENCES ON 741 COUNTERREVOLUTIONARIES AT HANGCHOW

In accordance with the "Law of the People's Republic of China on the Punishment of Counterrevolutionaries", 741 counterrevolutionaries were tried and sentenced at Hangchow as follows:

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
1. Death by Firing	Wang Ho-yeu (王訥言)	Male	50	T'ien-t'ai
Squad	Hsu Ts'ang-hsu (徐漢虛)	Male	47	Chu-chi
	Chou P'ei-kan (周培幹)	Male	61	Chu-chi
	Wang Chi-sheng (王吉生)	Male	42	Hang-chou-shih
	Hou Fu-sheng (侯福生)	Male	55	Chu-chi
	Lu Tsung-ying (陸宗英)	Male	46	Tu-yang
	Yu Hsiao (袁顯)	Male	34	Hsiao-shan
	Chang Kuen-ming (張觀明)	Male	45	Hang-chou-shih
	Chung Lien-chen (鍾連珍)	Male	29	Shao-hsing Chekiang
	Sung Tzu-yuan (宋子元)	Male	42	Shao-hsing Chekiang
	Lu Lai-chin (盧來金)	Male	31	Hang-chou-shih
2. Death sentence after 2 years of hard labor	Tang Hsi-yao (唐錫堯)	Male	52	Hang-chou-shih
	Chiang Chia-mei (江家楣)	Male	57	Wu-yuan Kiangsi
3. Imprisonment for indefinite period	Chen Shih-liang (陳士良)	Male	35	Chu-chi Chekiang

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Shen Chun-fu (沈俊甫)	Male	62	Hang-chou-shih
	Lu I-hsi (陸義熙)	Male	37	Hsiao-shan, Chekiang
	Chen Chuan-ken (陳全坤)	Male	32	Wen-chou, Chekiang
4. 20 Years imprisonment	Wang I-jen (王毅仁)	Male	42	Shao-hsing, Chekiang
	Cheng Shao-nan (程紹南)	Male	32	Liu-an, Chekiang
18 Years imprisonment	Hsu P'eng-fei (許鵬飛)	Male	28	Yung-k'ang, Chekiang
15 Years imprisonment	Li Jung-hua (李榮華)	Male	31	Ch'ing-chou, Shantung
	Ch'ien Chung-chai (錢仲瑛)	Male	43	Ning-po, Chekiang
	Wang Chih-ch'eng (王治成)	Male	41	Tung-yang, Chekiang
	Hu P'ai-lin (胡柏林)	Male	35	Chu-chi, Chekiang
	Ying Wen-lan (應文蘭)	Male	39	Yung-k'ang, Chekiang
	Hsu Keng-sheng (許更生)	Male	33	Hang-chou-shih
	Chang Yung-ch'uan (常鴻源)	Male	41	Shao-hsing, Chekiang
12 Years imprisonment	Ts'ao CH'un-lin (曹春林)	Male	53	Shao-hsing, Chekiang
10 Years imprisonment	Po Wen-hui (柏文淵)	Male	55	Hang-chou, Chekiang
	Li T'ai-ho (李泰和)	Male	47	Yu-hsien, Honan
	Ts'ai Shun-hsiang (蔡順祥)	Male	41	Hsiao-shan, Chekiang

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Teh Chung-yu (葉仲玉)	Male	64	Hang-chou-shih
	Hsiang T'ien-i (項天一)	Male	41	Lin-hai, Chekiang
	T'ien Tsu-k'ai (譚相凱)	Male	45	Ho-fei, Anhwei
	Ch'ien C hing-k'uei (錢景卿)	Male	37	Shao-hsing, Chekiang
	Wang Han-hsiung (王漢雄)	Male	31	Chu-chi, Chekiang
	Feng Chih-k'uei (馮志魁)	Male	50	Chu-chi, Chekiang
	Hu P'io (胡璞)	Male	42	Hang-chou-shih
	Yao Pao-shun (姚寶鈞)	Male	64	Hang-chou-shih
	Wu Hsieh-k'ang (吳燦康)	Male	35	Yu-yao, Chekiang
	Ma Fu-t'ang (馬福堂)	Male	23	Ching-chiang Chekiang
	Ten Shu-hsien (陳淑賢)	Male	27	Shao-hsing, Chekiang
	Tai Shu-liang (戴良良)	Male	58	Chia-shen, Chekiang
	Ten Fu-ping (陳富平)	Male	37	Hang-chou-shih
	Ma Chin-shu (馬正樹)	Male	67	Tung-ho, Kiangsu
	Kuo A-ching (郭阿慶)	Male	34	Heiao-shan, Chekiang
	Huang Chang-ken (黃長根)	Male	52	Shao-hsing, Chekiang
9 Years Imprisonment	Hsu Te-Yuan (徐德元)	Male	31	Ch'ang-shan, Kiangsi
	Iu Shan-ch'ien (陸善謙)	Male	43	Hang-chou-shih
	Hsia K'uei-te (夏奎德)	Male	21	Shao-hsing, Chekiang
8 Years imprisonment	Wang Shih-ying (王士瑩)	Male	52	Hang-h'ien, Chekiang
	Mao Tsung-yu (毛宗瑜)	Male	23	Hang-chou-shih

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Yeh Chin-lung (葉金龍)	Male	24	Shao-hsing, Chekiang
	Ch'en Yuan-shan (陳元善)	Male	39	Yung-chia, Chekiang
	Wang Ta-chon (汪達貞)	Male	50	T'ung-lu, Chekiang
	T'ang Chang-sheng (湯掌生)	Male	34	Hsiao-shan, Chekiang
	Yang Wen-lung (楊文龍)	Male	46	Hsiao-shan, Chekiang
	Chang Yu-yu (張幼餘)	Male	26	Hsiao-shan, Chekiang
	Lu Ju-p'eng (盧如鵬)	Male	42	Hsiao-shan, Chekiang
	Lu Fu-lin (盧敬林)	Male	40	Ch'ung-to, Chekiang
	Hi Chin-pao (倪金寶)	Male	30	Hang-chou-shih
	Hung Jung-chiao (洪榮昌)	Male	32	Hang-chou-shih
	Hsu Pao-lin (許寶麟)	Male	48	Hang-chou-shih
	Chieng Ch'i (程琦)	Male	42	Cheng-tu, Szechwan
	Chao Hui-keng (趙維庚)	Male	34	Hsiao-shan, Chekiang
	Ma Ch'i-lin (馬其林)	Male	58	Yung-kiang, Chekiang
	Heng Hsiao-ch'un (程浩靜)	Male	26	Hang-chou-shih
	T'ao Tsun-yueh (陶尊岳)	Male	27	Shao-hsing, Chekiang
	Lai Shui-ying (來水英)	Female	51	Hsiao-shan, Chekiang
	Chang Hou-ch'uan (張厚泉)	Male	32	Hui-yang, Kwangtung
	Tung Shih-jung (董世榮)	Male	34	Feng-hua, Chekiang
	Hu Chien-fan (吳劍凡)	Male	42	Hunan
	Fang Han-hsing (方漢興)	Male	23	Hsiao-shan, Chekiang
	Sun Wei (孫威)	Male	24	Hang-chou-shih
	Wang Yu-lin (王雨林)	Male	40	Hang-chou-shih

7

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Hsu Yin-po (徐寅伯)	Male	26	Chia-hsing, Chekiang
	Chu Te-fa (朱德範)	Male	28	Hang-hsien, Chekiang
7 Years imprisonment	Ch'en Ying (陳英)	Male	27	Hang-chou-shih
	Shao Kuo-hua (邵國華)	Male	50	Hang-chou-shih
	Wang Hui-an (王槐安)	Male	48	Shao-hsing, Chekiang
	Shen Ch'ing (沈清)	Male	46	I-hsing, Kiangsu
	Hu Hsi-kou (吳錫璠)	Male	34	P'iu-chiang, Chekiang
	Hsieh Chih-oh'1 (謝志齊)	Male	40	I-hsing, Kiangsu
	Liu Han-chang (劉漢章)	Male	41	Chu-jung, Kiangsu
	Hsiang Chung-san (項仲三)	Male	50	P'iu-chiang, Chekiang
	Li Chun-shih (李俊士)	Male	50	Heian-hsiang, Hunan
	Wang Shen-t'ing (汪煥庭)	Male	34	Heiao-shan, Chekiang
	Fang Chin-ta (方智達)	Male	30	Hang-chou-shih
	Shang Chi-hsuan (尚淑萱)	Male	46	Ts'u-Yang, Shantung
	Hu Chien-yu (吳劍煜)	Male	39	Shao-hsing, Chekiang
	Chu Chen-lu (杜振豫)	Male	44	Hang-chou-shih
	Li Chen-hue (李振華)	Male	43	Wu-Ch'ang, Huoh
	Wang H'ei-ken (王培根)	Male	38	Hang-chou-shih
	Hsu Hao-orh (徐毛兒)	Male	37	Shao-hsing, Chekiang
	Wang Ting-wei (王定威)	Male	44	T'ien-t'ai, Chekiang
--- Ch'endehinokx	Ch'en Chin-Jung (陳錦榮)	Male	54	Hang-chou-shih
	Chang Hung-shu (張鴻書)	Male	48	Fu-yang, Chekiang
	Tsang Yung-fa (湯永法)	Male	35	Chu-chi, Chekiang
	Chang Tsu-en (張祖恩)	Male	36	Chu-chi, Chekiang

CONFIDENTIAL

- Sentence
=

<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
Tao Chih-hsin (姚志新)	Male	37	Chiang-shan, Chekiang
Chin Ch'in-nan (金欽南)	Male	40	Tung-yang, Chekiang
Hsia Hsi-fen (夏海芬)	Male	37	Hu-yang, Chekiang
Yueh Peng-pin (岳鵬斌)	Male	45	Yung-k'ang, Chekiang
Hsu Chih-hung (徐志鴻)	Male	38	Kang-chow-shih
Chang Hsiao-ch'uan (楊小傳)	Male	46	Hsiao-shan, Chekiang
Chang Tsau-ming (章子明)	Male	30	Hsiao-shan, Chekiang
Yang Wen-kung (楊文恭)	Male	31	Kang-chow-shih
Wang Li-sheng (黃麗生)	Male	39	Ch'ing-t'ien, Chekiang
Hsiao Shou-chung (肖守衷)	Male	61	Ch'ing-t'ien, Chekiang
Li Hsi-yuen (李德元)	Male	40	Kang-chow-shih
Chin Jung-huai (陳榮煥)	Male	34	Hsiao-shan, Chekiang
Chin Yun-p'eng (陳雲鵬)	Male	36	Kang-chow-shih
Wang Chin-k'uan (王金坤)	Male	38	Hsiao-shan, Chekiang
Chiang Ping-jen (蔣炳賢)	Male	38	Hsing-o-shih
Hsu Shou-tsung (徐壽增)	Male	39	Kang-chow-shih
Chao T'ien-sh'ang (趙天盛)	Male	33	Kang-chow-shih
Hsu Chin-shui (許金水)	Male	48	Hsiao-shan, Chekiang
Chang Yuei-sheng (楊桂生)	Male	33	Kang-chow-shih
Juan Yang-jen (阮楊仁)	Male	41	Chu-chi, Chekiang
Hung Hsi-ts'ai (洪贊財)	Male	44	Kang-chow-shih
Shen Hsin-teo (沈新道)	Male	35	Hsin-ch'ang, Chekiang
Yu Chin-yuan (俞金元)	Male	46	Chu-chi, Chekiang
Shen Hung-pin (沈鴻斌)	Male	20	Hsi-ning, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Chang Kuo-ch'ing (張國慶)	Male	43	Chu-chi, Chekiang
6 Years imprisonment	Wang Yu-wen (王郁文)	Male	36	P'u-chiang, Yhekiang
	Chu Heng-fu (朱能富)	Male	47	Kang-chou-shih
	Chu K'o-chin (朱克勤)	Male	31	Ts'u-ch'i, Chekiang
	W'eng Shou-yu (翁守愚)	Male	47	Chia-hsing, Chekiang
	Li Ts'ie (李傑)	Male	47	Shan-Ch'eng-tu, Szechwan
	Wu Yu-ming (胡福明)	Male	33	Hing-po-shih
	Kuo Ts'u (郭時)	Male	41	Kang-chou-shih
	Sun Chin-hsin (孫金鑫)	Male	35	Shao-hsing, Chekiang
	Chiang C h'ih-fu (蔣熾夫)	Male	41	Ch'ing-chen, Kweichow
	Lo Yung-ch'ing (羅永慶)	Male	25	Kang-hsien
	Chiang A-kou (蔣阿狗)	Male	41	Kang-chou-shih
	Shih Tsung-jui (施宗瑞)	Male	32	Hsiao-shan, Chekiang
	Sheng Kuo-chen (盛國顯)	Male	35	Kang-chou-shih
	Jen Ti-p'ing (任世平)	Male	30	Hsiao-shan, Chekiang
	T'sai Meng-chi (蔡孟麟)	Male	32	Chu-chi, Chekiang
	Kuang Hsien-jui (黃曉瑞)	Male	23	Kang-chou-shih
	Yao Ts'ung-wen (姚從文)	Male	32	Ching-te, Anhwei
	Hsu Shih-hong (徐世衡)	Male	49	Hsiao-hsing, Chekiang

CONFIDENTIAL

<u>8 sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
5 Years imprisonment				
	Kuo Yao-chang (郭耀章)	Male	54	Chu-chi, Chekiang
	Chu Shih-ch'uan (朱世權)	Male	50	Hu-Ch'ing, Hopen
	Hsu Han-ch'eng (許漢澄)	Male	53	Hang-hsien, Chekiang
	Hsu Tsu-ta (徐祖達)	Male	38	Chien-to, Chekiang
	Jui Chiang-ch'eng (蔣蔣成)	Male	42	Li-shui, Kiangsu
	Yu Pao-hsing (俞寶興)	Male	37	Hang-chou-shih
	Chin Ch'in-ch'uan (金欽泉)	Male	47	Shao-hsing, Chekiang
	Yu Ching-ch'ing (于鏡清)	Male	44	Yau-ning, Kiangsu
	Hsu Wen-jun (虎問潤)	Male	53	T'ai-yuan, Shansi
	Ch'i Kwang-Yu (戚光宇)	Male	41	Hang-chou-shih
	Chu Ching-sheng (史靜生)	Male	49	Shao-hsing, Chekiang
	Cheng Chün-shou (程錦源)	Male	48	Shao-hsing, Chekiang
	Chung Tai-lin (陳柏林)	Male	39	Shao-hsing, Chekiang
	Li Chin-yuan (李其源)	Male	34	Hu-yang, Chekiang
	Ho Ju-ch'ü (何居初)	Male	37	Yueh-yang, Hunan
	Chin Chih-wen (陳吉文)	Male	44	Hang-chou-shih
	Wu Yueh-wen (吳月文)	Male	38	Hsien-chu, Chekiang
	P'ien Shih-ken (邊石根)	Male	50	Tung-yang, Chekiang
	Li Tung-sheng (李東昇)	Male	55	Hang-chou-shih
	Chiang Chun-sheng (蔣春生)	Male	25	Shao-hsing, Chekiang
	Mao Hung-hsun (茅鴻勳)	Male	37	Hang-chou-shih
	Ts'ai Chih-kao (蔡志高)	Male	26	Hsiao-shan, Chekiang
	Chin Hsien-yao (金顯耀)	Male	25	Hang-chou-shih
	Chou Kuei-lin (周桂林)	Male	30	Chu-chi, Chekiang
	Yu Lien-ssu (余聯騷)	Male	31	Hang-chou-shih

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Wu Shih-k'uei (吳世奎)	Male	49	Hang-chou-shih
	Chang Yen-ch'ing (張廷慶)	Male	31	Hang-chou-shih
	Wen Chih-jung (聞如榮)	Male	47	Hang-chou-shih
	Yeh Chih-ken (葉其根)	Male	33	Shao-hsing, Chekiang
	Lo Ming-tao (羅明道)	Male	43	Kiangsu
	Wang Ch'ang-keng (汪長庚)	Male	29	Hang-chou-shih
	Sun Hsing-sheng (孫杏生)	Male	43	Hang-chou-shih
	Chang Yin-sheng (鄭銀生)	Male	27	Hang-chou-shih
	Tsai Fu (崔甫)	Male	36	Ts'un-chou, Hunan
	Hsu Kai-miao (徐開標)	Male	45	Chiang-shan, Chekiang
	Yuan Ju-ch'uan (袁述川)	Male	25	T'ien-t'ai, Chekiang
	Tseng Chen-ch'iu (曾振球)	Male	32	Ch'i-yang, Hunan
	Wu Ming-yu (吳明玉)	Male	49	I-wu, Chekiang
	Shih Yung-ts'ai (史育才)	Male	27	Ning-po, Chekiang
	Wang Hsin-yuan (王辛元)	Male	31	Shao-hsing, Chekiang
	Chang Chung-ying (張仲英)	Male	41	Chia-ting, Kiangsu
	Chiang Hsiang-yu (蔣相友)	Male	30	Hsien-chu, Chekiang
	Chu Ch'un-hou (朱春侯)	Male	43	Chia-hsing, Chekiang
	Wu A-niu (吳阿牛)	Male	25	Hang-chou-shih
	Feng Feng-ch'un (馮鳳春)	Male	30	Shao-hsing, Chekiang
	Wang Shui-ken (汪水根)	Male	35	Hang-chou-shih
	Wang Ch'un-hung (王春洪)	Male	33	Hang-chou-shih
	Li Yen-ling (李延齡)	Male	29	Shao-hsing, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Li Ch'ing-hua (李晴華)	Male	33	Tu-chin, Kiangsu
	Lin Ching (林 靜)	Male	46	Hang-chow-shih
	Sung Hsing-ch'ang (宋行暢)	Male	27	Tz'u-ch'i, Chekiang
	Wang Shau-jen (汪衛人)	Male	49	Ku-shih, Honan
	Hsu Yuan-pai (許元白)	Male	53	Kai-hsien, Anhwei
	Cheng Jui-chung (鄭瑞忠)	Male	42	Kai-hsien, Chekiang
	Hsu A-ch'ang (徐阿昌)	Male	39	Shao-hsing, Chekiang
	Cheng Chung-fu (鄭忠福)	Male	36	Yen-chow, Chekiang
	Ch'ien Te-mu (陳德華)	Male	60	Han-chow-shih
	Yen Hing-ch'uan (嚴炳泉)	Male	30	Shao-hsing, Chekiang
	Chin Chi-so-hon (金樹根)	Male	39	Hang-chow-shih
	Li Chin-hsien (李錦賢)	Male	29	Hang-chow-shih
	Chen Chin-mo (陳金茂)	Male	40	Tu-yao, Chekiang
	Hu Shau-ch'iu (胡順初)	Male	37	Hang-chow-shih
	Ts'ai Ma-hsien (蔡慕賢)	Male	25	Shao-hsing, Chekiang
	Chou Jeng (周 登)	Male	28	Shao-hsing, Chekiang
	Hsiang Shih (項 烈)	Male	42	Hsien-chu, Chekiang
	Yin Kuo-chung (尹國忠)	Male	29	Lo-shan, Szechwan
	Kung Hsiao-shih (孔小士)	Male	30	Hsiao-shan, Chekiang
	Hao P'ei-shan (毛培珊)	Male	34	Wu-yu-shan, Kiangsi
	Cheng Chin (鄭 謹)	Male	32	Hang-chow-shih
	Yu Wen-lung (俞文龍)	Male	27	Hsiao-shan, Chekiang
	Shen Yen-t'ang (沈燕堂)	Male	36	Shao-hsing, Chekiang
	Chao A-hu (趙阿虎)	Male	24	Hang-chow-shih
	Wang Pao-sen (王寶森)	Male	32	Tung-yang, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Chia Ch'eng (賈 城)	Male	40	Jan-shou, Szechwan
	Huang Tao-ming (黃道明)	Male	31	Hang-chow-shih
	Lu Chieh (魯 杰)	Male	34	Hang-chow-shih
	Wu Ping (吳 平)	Male	29	Ko-chiang, Szechwan
	Chai Yin-sheng (翟寅生)	Male	37	Hang-chow-shih
	Sui K'ang (孫 剛)	Male	43	Wu-hsing, Chokiang
	Lou Hsi-lin (盧 錫麟)	Male	40	Shao-hsing, Chokiang
	Ch'iu Lai-fong (裘來豐)	Male	39	Shao-hsing, Chokiang
	Hsu Chia-yao (徐家曜)	Male	28	Hang-chow-shih
	Chou I-min (周 明)	Male	34	Chiang-shan, Chokiang
	Chiang C'han-fu (蔣展毅)	Male	70	Hang-chow-shih
	Hsu Chih-hsin (華立新)	Male	26	Tung-yang, Chokiang
	Ko Chun-sheng (葛俊生)	Male	42	Hang-chow, Chokiang
	Ch'ien T-shou (陳同壽)	Male	26	Hang-chow-shih
	Lu I (陸 毅)	Male	37	Hang-chow-shih
	Chou Yu-ch'eng (周玉成)	Male	34	Ch'ang-hsien, Chokiang
	Shen Chu-lin (沈菊林)	Male	35	Te-ch'ing, Chokiang
	Chu Chi-p'ing (朱濟平)	Male	26	Hang-chow-shih
	Yeh Kuan-lin (葉開林)	Male	55	Hsiao-shan, Chokiang
	Ma Yung-fu (馬永福)	Male	50	Chu-chi, Chokiang
	Ko A-wu (葛阿五)	Male	52	Hang-chow-shih
	Chou Te-t'ai (周德泰)	Male	59	Shao-hsing, Chokiang
	Shih K'ai-chin (施開金)	Male	43	Hsiao-shan, Chokiang
	Chiang Sung-fa (蔣宋法)	Male	44	Hsiao-shan, Chokiang
	Shen Yung-fang (沈雍芳)	Male	18	Hang-hsien, Chokiang
	Pao Chin-ch'uan (鮑金泉)	Male	55	Hang-chow-shih

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Chang Yun-piao (章雲標)	Male	42	Hsiao-shan, Chekiang
	Chin Ch'un-po (金壽坡)	Male	35	Hai-ning, Chekiang
	Chou Hsiao-fen (周小凡)	Male	42	Hsiao-shan, Chekiang
	Yang Hou-ch'en (楊厚臣)	Male	43	Wu-ho, Anhwei
	Chung Yun-yu (鍾韻玉)	Male	45	Hang-chou-shih
	Liu Cheng-hsin (劉正華)	Male	25	Hsiao-feng, Chekiang
	Wu I-feng (吳一峯)	Male	22	Ch'ing-pai, Chekiang
	Ch'en Chin-fu (陳宜福)	Male	27	Siao-hsing, Chekiang
	Kang Chin-p'ei (王群培)	Male	28	Hang-chou-shih
	Li Ch'ang-ch'un (李長春)	Male	31	Hang-ch'ao, Anhwei
	Kao Kuo-hai (高國海)	Male	23	Ch'ang-hsing, Chekiang
	Chou Shih-k'ei (周時基)	Male	26	Ch'ang-hsien, Chekiang
	Li Yen-hung (李和興)	Male	27	Chia-lo, Hunan
	Pei Yu-feng (白玉峯)	Male	34	T'ai-shan, Shantung
	Liu Kou-chi (劉謀濟)	Male	31	Iao-hsien, Szechwan
	Ch'en Ch'uan-fu (陳宜福)	Male	34	Hsiao-shan, Chekiang
	Chao Ku-sheng (趙復生)	Male	49	Hang-chou-shih
	Ch'en Kou-k'ang (陳厚康)	Male	28	Ch'ang-hsien, Chekiang
	P'ien Ho-lin (潘葆霖)	Male	26	Shang-yu, Chekiang
	Ch'en Jung-sheng (陳融生)	Male	34	Su-chou, Kiangsu
	Hu Hsi-ch'uan (胡希全)	Male	34	Hang-chou-shih
	Zhu Ju-yin (朱福銀)	Male	25	Hang-chou-shih
	Wu Yung-yao (吳永耀)	Male	24	Hang-chou-shih
	Shen Fu-ken (沈福根)	Male	34	Hang-chou-shih
	Ts'ao Chen (曹振)	Male	58	Len-ch'i, Chekiang
	Ma Ch'ing-ho (馬清河)	Male	27	Tung-yang, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Hong T'ing-fang (孟廷芳)	Male	36	Yu-yao, Chekiang
	Hsu Chin-yu (徐金如)	Male	52	Shao-hsing, Chekiang
	Chao Ping-fu (趙炳甫)	Male	52	Hang-chou-shih
	Yueh Ch'ung-sen (岳崇森)	Male	25	Yung-k'ang, Chekiang
	Wang Chia-ch'i (王家璣)	Male	31	Hang-chou-shih
	Kao Te-jen (高德仁)	Male	40	Ch'ang-sha, Chekiang
	Chang Kuang-shui (張光水)	Male	40	Hang-chou-shih
	Yang Kun-chia (楊承嘉)	Male	45	Shao-hsing, Chekiang
	Chou Chi-wei (周啟渭)	Male	31	Hang-chou-shih
	Chu Jung-t'ang (杜榮堂)	Male	52	Shao-hsing, Chekiang
	Cheng Chi-ch'ao (張奇朝)	Male	25	Shao-hsing, Chekiang
	Fong Chin-nan (馮晉南)	Male	46	Hang-chou-shih
	Hong Chin-hua (洪錦華)	Male	25	Shao-hsing, Chekiang
	Yeh Chin-te (葉錦德)	Male	37	Shao-hsing, Chekiang
	Yao Pen-li (姚全里)	Male	23	Hang-chou-shih
	Kung Hsiao-k'ang (孔賢康)	Male	43	Tung-yang, Chekiang
	Jao Kuo-fan (焦國芳)	Male	50	Chiu-chiang, Kiangsi
	Li Sheng-yuen (李聲元)	Male	28	Chekiang
	Kuo Chin-te (顧明德)	Male	26	Shao-hsing, Chekiang
	Kao Wen-yao (王文耀)	Male	51	Hang-chou-shih
	Cheng I-min (章逸民)	Male	35	Hu-hsing, Chekiang
	Ch'ien Hsi-k'ang (陳錫康)	Male	20	Shan-yin, Kiangsu
	Kao Yao-k'uei (毛耀奎)	Male	51	Hang-chou-shih
	Yeh Chin-ch'uan (葉錦泉)	Male	34	Kwangtung
	Huang Ch'en-onien (黃聲健)	Male	50	Hang-chou-shih

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	W1 Chih-chin (倪治群) Male	Male	43	Shao-hsing, Chekiang
	I-ch'ing-chung (龔平中) Male	Male	36	I-pin, Szechwan
	Yuan Hsi-ch'uan (袁錫傳) Male	Male	45	Shao-hsing, Chekiang
	Wu Yu-chung (伍裕恭) Male	Male	32	Hsu-1, Anhwei
	Li Tsu-yun (李士雲) Male	Male	54	Lin-hsi, Chekiang
	Huang Shao-hua (黃少華) Male	Male	29	Hang-chou-shih
	Hu Ch'ung (傅誠) Male	Male	43	Hang-chou-shih
	Hsu Tsu-yun (徐士雲) Male	Male	39	Lan-ch'i, Chekiang
	Ling Chin-Ch'uan (凌金器) Male	Male	39	Hsiao-shan, Chekiang
	Yeh C h'ing-chiang (葉清江) Male	Male	40	Sheng-yu, Chekiang
	Ch'ong Hsi-ch'ing (翁錫青) Male	Male	38	Yueh-yang, Hunan
	Shih Hsiang-fu (石良復) Male	Male	32	Shao-hsing, Chekiang
	Liu Tsung-shan (劉頌善) Male	Male	51	T'ai-chou, Kiangsu
	Chen Yung-ch'uan (陳湧泉) Male	Male	31	Hang-chou-shih
	Hao Wen-feng (何文芳) Male	Male	31	Hsiang-ho, Hopoh
	Huo Ch'ang-ken (霍長根) Male	Male	26	Hang-chou-shih
	Ch'ien Hsueh-yuan (錢學源) Male	Male	41	Lin-an, Chekiang
	Hsu Tsu-wei (韓祖堯) Male	Male	31	Shao-hsing, Chekiang
	Liu Hsueh-ch'uan (劉學春) Male	Male	35	Shang-ch'iu, Honan
	Lu Chin-lung (陸金勝) Male	Male	24	Hang-chou-shih
	Chao Han-hsin (趙漢信) Male	Male	32	Chu-chi, Chekiang
Y	Yueh			
	Weng Yueh-yao (翁月瑤) Male	Male	38	Hang-chou-shih
	Wang Tsung-lin (王宗林) Male	Male	41	I-ch'ang, Kuoh
	Ch'en Pao-hua (陳寶華) Male	Male	24	Hang-chou-shih
	Li Shih-yueh (李志岳) Male	Male	29	Hang-chou-shih

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Ch'en shin-piao (陳鑫標)	Male	23	Shao-hsing, Chekiang
	Chu Kuo-liang (諸國亮)	Male	47	Shao-hsing, Chekiang
	Chang Hsiao-Chiang (張筱江)	Male	52	Hang-chow-shih
	Shih Yi-ch'un (史迪羣)	Male	35	Yu-taiien, Chekiang
	Li Tsung-hsiang (李崇湘)	Male	34	Chia-ho, Hunan
	Yang Chung-yu (楊忠裕)	Male	35	Hang-chow-shih
	Yang Ching-ch'ang (楊鏡璋)	Male	49	Hsiao-shan, Chekiang
	Tuan Hu-cheng (端木正)	Male	57	Ch'ing-t'ien, Chekiang
	Hu Chen-t'ien (胡根鈞)	Male	27	Hsiao-shan, Chekiang
	Chu Ta-Chang (朱大章)	Male	55	Hang-chow-shih
	Shen Tsu-ch'u (滕梓初)	Male	31	Hang-chow-shih
	Chiang S hao-pin (張紹斌)	Male	29	Hsi-hsien, Anhwei
	Chang-Fai-p'eng (唐飛鵬)	Male	31	Hang-chow-shih
	Yang Hung-ch'i (王鴻璣)	Male	55	Hsien-chu, Chekiang
	Ch'en Hsi (陳璽)	Male	52	Hsiao-shan, Chekiang
	Chung Kuo-lan (鄭國林)	Male	42	Shao-hsing, Chekiang
	Ch'en Kuo-liang (陳國綱)	Male	30	Hang-chow-shih
	Ch'en Hsiu-yin (陳淑英)	Male	26	Hang-chow-shih
	Ching Hung-cheng (荆炳正)	Male	45	Hsi-aho, Honan
	Chiang Chia-ming (江宜明)	Male	44	Hsi-hsien, Anhwei
	Teng Hsiao-ju (湯肇儒)	Male	45	Ch'ang-chow, Fiangsu
	Sh Tsch-feng (史楚峰)	Male	43	Sh'ien-t'ai, Chekiang
	Ch'iu Wen-hua (邱文華)	Male	28	Chen-chiang, Kiangsu
	Chai Jung-ch'uen (蔡榮泉)	Male	27	Hang-chow-shih
	Mao Jung-sheng (毛榮生)	Male	34	Hang-chow-shih
	Kuo Ch'unkuan (郭春官)	Male	37	Hsiao-shan, Chekiang

CONFIDENTIAL

Bartong

Box	Age	Native Origin
Yu Yu-sheng (于友生) Male	51	Hsiao-shen, Chekiang
Ch'en Ho-tu (陳伯濤) Male	43	Hin-an, Chekiang
Lin Pin-tai (林顯輝) Male	38	Chenhai, Chekiang
Wang Hsi-feng (王海峰) Male	40	Hsiang-sheng, Honan
Chi Ch'ien-kuo (吉承寬) Male	47	Hsiao-shen, Chekiang
Hu Hsiu-hsiang (胡香祥) Male	41	Tsao-shing, Chekiang
Chi Hsiang-tung (紀任硬) Male	26	Hsiang-chou-shih
Chang Hsi-ming (常再明) Male	29	Hsiang-chou-shih
Chang Chien-min (陳錦明) Male	27	Hsiao-shen, Chekiang
Chen Hsien-lin (陳煥林) Male	20	Hsiang-chou-shih
Chang Ch'ien (鄭成) Male	39	Hsiao-shen, Chekiang
Yang Hsi-hong (楊惠洪) Male	4	Hsiang-chou-shih
Ho Hsiang (高顯綱) Male	35	Hsiao-shen, Chekiang
Chen Hsi-hsing (陳惠興) Male	32	Hsiao-shen, Chekiang
Chou Hsi-fa (周志法) Male	31	Hsiao-shen, Chekiang
Ch'en Shui-t'ang (陳水堂) Male	49	T'ien-t'ai, Chekiang
Wen Hsi-yen (溫阿英) Male	48	Hsiang-chou-shih
Liu Sheng-fa (劉生法) Male	33	Fao-chou, Kwangtung
Ch'en Hsiang-fa (陳良發) Male	37	Hsiang-chou-shih
Li Hsiu-lin (李子林) Male	34	Hsiao-shen, Chekiang
Mo Chang-tai (莫張燦) Male	41	Hsiang-chou-shih
Ch'u Chang-hsin (蔡中心) Male	27	Hsiang-chou-shih
Tsao Yeh (陶治) Male	43	I-wu, Chekiang
Chang Hsi-i (張子儀) Male	43	Tung-yang, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Age</u>	<u>Native Place</u>
	Chu Sung-te (祝 松德) Male	42	Lan-hai, Chekiang
	Chiang Chih-fang (江志航) Male	54	Feng-fu, Chekiang
	Li Yung-fu (羅維甫) Male	33	Hong-chow-shih
	Tai K'ai-fang (蔡偉良) Male	69	Hong-chow-shih
	Yao Yu-shih (姚友梅) Male	42	Te-ch'ing, Chekiang
	Yu Shu-fu (俞四福) Male	35	Hong-chow-shih
	Chang Ch'ing-sheng (張慶生) Male	49	Hong-chow-shih
	Yang To-shuan (黃德煥) Male	73	Chien-ling, Anhwei
	Chang Shu-chin (章如金) Male	36	Lan-shih-shih
	Li Shou-shan (李寶根) Male	50	Shao-hsing, Chekiang
	Chu Shu-shan (徐文忠) Male	67	Shin-shan, Chekiang
	Lou Ch'uan-pao (樓傳寶) Male	49	Hong-chow-shih
	Yu Shau-shan (袁仲謙) Male	33	Hong-chow-shih
	Li Shu-fu (李天烈) Male	33	Shing-chow-shih
	Yang Chien-ch'uan (楊植泉) Male	32	Hong-chow-shih
	Ch'ien Tze-yen (田河權) Male	55	Hong-chow-shih
	Shan T'ing-shao (沙庭浩) Male	32	Hong-chow-shih
	Shen Yu-shin (沈有林) Male	29	Hong-chow-shih
	Mo Shun (莫 楚) Male	30	Hong-chow-shih
	Yang Hung-ch'uan (楊洪泉) Male	70	Hong-chow-shih
	Shu Cheng-chih (謝尚志) Male	58	Chi-shan, Anhwei
	Ch'ung Kuo-hs'uan (童國煥) Male	31	Hong-chow-shih
	Hsiang Ch'ang-hu (項昌虎) Male	29	Lo-ch'ing, Chekiang
	Ch'ien Yu-keng (陳玉根) Male	28	Chien-to, Chekiang
	Tai Shui-ch'uan (戴水泉) Male	34	Hong-chow-shih
	Loi Chin-yu (來近猷) Male	29	Chiao-shan, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Ch'i Shao-jung (戚紹榮)	Male	53	Ku-ch'ang, Shantung
	Yang Hsu-ch'u (楊旭和)	Male	31	Hain-ch'ang, Chekiang
	Ch'iu Chih-kang (邱志剛)	Male	36	Kang-chou-shih
	Wang Ku-lin (王玉麟)	Male	32	Shang-yu, Chekiang
	Shen Hsi-ch'u (沈希和)	Male	35	Hsien-chu, Chekiang
	Wu Hsiang-yun (吳翔雲)	Male	35	Ch'u-anou, Chekiang
	Chen Wang-fu (陳望夫)	Male	25	Ch'u-anou, Chekiang
	Wang Tsang-yang (王清揚)	Male	36	Sun-yang, Chekiang
	Ch'ien Ch'eng-shi (錢成石)	Male	32	Hing-pa, Chekiang
	Hu Ch'ien (胡 健)	Male	35	Ch'ien-ho, Chekiang
	Yang Hsi-ch'iu (楊希秋)	Male	35	Ch'ien-ho, Chekiang
	Li Yen-ch'iu (李業秋)	Male	39	Ku-shi, Anhwei
	Ho Tiao (何 譚)	Male	32	Hsi-ch'ang, Chekiang
	Shen Mi-hua (沈禮華)	Male	17	Ho-fai, Anhwei
	Ch'iu Ting-fu (邱庭福)	Male	36	Ch'ang-tu, Kiangsu
	Hu Ch'ing-ch'iu (胡青秋)	Male	39	Ch'ien-ho, Anhwei
--- Ch'ien-shen ---				
	Ch'ien Chih-Chen (陳吉順)	Male	25	Ch'ien-ho, Kiangsu
	Ch'ien Hsi-ch'iu (陳希秋)	Male	33	Ch'u-chi, Chekiang
	Cheng Ting-Ch'ing (程庭清)	Male	20	Kang-chou-shih
	Cheng Shih-hsun (張時訓)	Male	35	Ch'u-ch'ang, Chekiang
	Cheng I-ch'uan (張以俊)	Male	36	Ho-fai, Anhwei
	Ch'ien Yang-hua (錢永華)	Male	30	Kang-chou-shih
	Yen Liang (嚴 良)	Male	28	Chen-hai, Chekiang
	Shen Hsi-ch'iu (沈希秋)	Male	32	Shanghai-shih
	Chu Cheng-hua (儲 華)	Male	20	Ch'ang-tu, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Huang Tung-k'un (黃誦坤)	Male	36	Kang-chou-shih
	Sung H i-shen (宋適申)	Male	18	Siao-chung, Liaoning
	Huang Shao-hsuan (黃紹璦)	Male	40	Jung-hsien, Kwangsi
	Tung Tai'o-wan (董泰三)	Male	46	Tu-hang, Chekiang
	Chin Pen-chun (金本恩)	Male	30	Wen-ch'ang, Chekiang

4 Years imprisonment

Shou Tai-an (壽錫安)	Male	27	Chu-an, Chekiang
Shen Chi-lin (沈繼霖)	Male	56	Kang-chou-shih
Kung Kiao-sheng (孔妙生)	Male	33	Kang-chou-shih
Wang Ch'ong-shun (王成順)	Male	29	Kang-chou-shih
Wang Pao-k'uei (汪寶奎)	Male	25	Kang-chou-shih
Ting Wen-shang (丁文尚)	Male	23	Kang-chou-shih
Chang Shou-fu (張壽福)	Male	32	Shao-hsing, Chekiang
Lo Yuo-chiang (羅國強)	Male	30	Lu-feng, Kwangtung
Tai'ai Yun-k'uei (蔡雲奎)	Male	27	Ch'ung-to, Chekiang
Ch'ien C hin-hai (陳金海)	Male	22	Sheng-yao, Kiangsi
Teng Tu-kung (鄧騰崇)	Male	29	Ching-an, Kiangsi
Shao Shui-keng (邵水根)	Male	24	Shao-hsing, Chekiang
Chu Min-chih (祝敏之)	Male	51	Min-hou, Fukien
C hou Hsiang (周祥)	Male	33	Shao-hsing, Chekiang
Yang Jung-yao (楊敬耀)	Male	29	Kang-chou-shih
Yi lich (易烈)	Male	23	Nan-tung, Kiangsu
Chang Tzu-cheng (張子徵)	Male	45	Yunnan
Chou H ui-yuen (周渭元)	Male	46	Shao-hsing, Chekiang
Hsu C hih-ch'eng (徐志誠)	Male	43	Tung-yang, Chekiang
Ch'ien C hin-chih (陳錦芝)	Male	34	Shu-yang, Kiangsu

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Age</u>	<u>Native Place</u>
	Tu Wei-kuo (杜維國) Male	33	Yuen-chiang, Hunan
	Shen Ming-ch'uan (沈明銓) Male	30	Lin-tai, Chokiang
	Li C. Hsueh-lin (黎中森) Male	31	Lo-fai, Hubei
	Yang Guo-lin (王嘉麟) Male	33	Lo-t'ing, Peking
	Chu Shai (朱水) Male	37	Chia-chieh, Szechwan
	Yeh C. Hsueh-lin (徐家祥) Male	37	Lo-fai, Yunnan
	Lo Chung-huan (何煒輝) Male	35	Lo-fai, Szechwan
	Chen Hsueh-lin (張軒和) Male	36	Lo-fai, Chokiang
	Cheng C. Hsueh-lin (張金海) Male	36	Lo-fai, Szechwan
	Yang Hsueh-lin (楊學倫) Male	37	Lo-fai, Szechwan
	Chiang Hsueh-lin (蔣台模) Male	36	Lo-fai, Szechwan
	Yang Hsueh-lin (楊) Male	36	Lo-fai, Szechwan
	Yang Hsueh-lin (楊阿士) Male	36	Lo-fai, Chokiang

3 Years Imprisonment

Yang Hsueh-lin (楊長林) Male	31	Lo-fai, Szechwan
Chen Hsueh-lin (陳學銘) Male	33	Lo-fai, Szechwan

3 Years Imprisonment

Chen Hsueh-lin (張水生) Male	33	Lo-fai, Szechwan
Chen Hsueh-lin (張永炎) Male	33	Lo-fai, Szechwan
Chen Hsueh-lin (張金水) Male	33	Lo-fai, Szechwan
Chen Hsueh-lin (張厚美) Male	33	Lo-fai, Szechwan
Chen Hsueh-lin (李掌鏡) Male	36	Lo-fai, Chokiang
Chen Hsueh-lin (張瑞壁) Male	37	Lo-fai, Szechwan
Chen Hsueh-lin (鄧福民) Male	37	Lo-fai, Szechwan
Chen Hsueh-lin (保世祥) Male	22	Yunnan, Yunnan
Chen Hsueh-lin (鄧傑) Male	25	Yunnan, Szechwan

CONFIDENTIAL

<u>Surname</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Hu Kuang-fa (傅光法)	Male	68	Shao-hsing, Chekiang
	Ch'en Hsi-mao (陳紀茂)	Male	36	Hsiao-shan, Chekiang
	Chen Chun-hsi (潘俊喜)	Male	23	Hu-chang, Anhwei
	Wu Hsiang-feng (吳香慶)	Male	24	Shao-hsing, Chekiang
	Chiu Chih-lin (劉志林)	Male	46	Lin-hsing, Kiangsu
	Ch'ao Chen-chiang (趙長江)	Male	39	Hsiang-shan, Chechi
	Hu Han-cheng (吳漢章)	Male	36	Yang-yu, Chekiang
	Cheng Chun-hua (鄭功華)	Male	40	Shao-hsing, Chekiang
	Ch'en Hsiang-shan (陳炳璽)	Male	31	Wu-chang-shih
	Ch'ao Hsiang-shan (吳祖璽)	Male	33	Hsiao-shan, Chekiang
	Yang Hsien-shan (楊蘭生)	Male	34	Hsiao-shan, Chekiang
	Huo Tso-chin (郭佐臣)	Male	35	Chin-hua, Chekiang
	Hong Tzu-ch'ing (洪子清)	Male	33	Shao-hsing, Chekiang
	Hsieh Chung-mo (薛仲漢)	Male	23	Hu-chang, Kiangsu
	Chu Shui-ch'uan (朱水傳)	Male	32	Hsiao-shan, Chekiang
	Li Chang-sh'ing (李長清)	Male	31	Hsiao-shan, Chekiang
	Hsu Wen-ping (徐文炳)	Male	41	Hong-chou-shih

	Hsieh Wen-jung (復根雄)	Male	26	Chen-shi, Chekiang
	Tsuen Ch'ing (譚清)	Male	53	Chien-hsien, Szechwan
	Hua Kuan-shien (華貫賢)	Male	29	Hsiao-shan, Chekiang
	Tsuen Hsiang-shan (袁子元)	Male	53	Hong-chou-shih
	Wang Hsiu-ch'iu (王旭初)	Male	27	Hong-chou-shih
	Ch'en Li-ch'eng (陳立成)	Male	66	Hong-chou-shih
	Yang Yung-hsin (楊永鑫)	Male	38	Shao-hsing, Chekiang
	Ch'en Ch'i-ch'uan (陳其傳)	Male	47	Hsiao-shan, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Chang Yun-hsien (章雲仙)	Male	40	Hsiao-shan, Chekiang
	Ch'en Ch'ang-kuai (陳長桂)	Male	20	Hsiao-shan, Chekiang
	Fang Chin-fa (方金法)	Male	33	Hang-chou-shih
	Xao Ch'eng-fu (高成甫)	Male	26	Hang-chou-shih
	Fang Ch'eng-mao (方成茂)	Male	59	Hsiao-shan, Chekiang
	Hou C'ui-ho (許春和)	Male	35	Hsiao-shan, Chekiang
	Feng Hui-pao (封本寶)	Male	26	Shiao-hsing, Chekiang
	Shih K'ai-cheng (施開成)	Male	43	Hsiao-shan, Chekiang
	Mi Hsiao-lung (倪寶龍)	Male	23	Hsiao-shan, Chekiang
	Hsu Te-lung (許德隆)	Male	46	Tung-yang, Chekiang
	Huang A-mao (黃阿毛)	Male	27	Shao-hsing, Chekiang
	Jen Te-fa (任德法)	Male	31	Shao-hsing, Chekiang
	Chi Hsuei-sen (嵇桂森)	Male	45	Ch'ang-shu, Kiangsu
	Huo Te-ming (許德明)	Male	29	Tsun-I, Kweichow
	Chou Chun-chih (周俊三)	Male	58	Ho-hsien, Szechwan
	Huo I-hung (毛以洪)	Male	32	Chieng-shan, Chekiang
	Hsien Lin (徐麟)	Male	30	Yu-chiang, Kiangsi
	Ch'en T'ien-shou (陳天收)	Male	29	I-wu, Chekiang
	Ho Ch'ing-sheng (何慶生)	Male	43	Lon-ch'i, Chekiang
	Shen			
	Sun Ling-wen (孫炳文)	Male	33	Tu-yang, Chekiang
	Wang I'eng-sen (王開三)	Male	26	Hsiao-shan, Chekiang
	Kuo Han-hsing (郭漢興)	Male	34	Hsiao-shan, Chekiang
	Hu Yung-ch'ao (吳永潮)	Male	34	Shao-hsing, Chekiang
	Yeh Chien-ming (葉劍鳴)	Male	28	Su-chou, Kiangsu

CONFIDENTIAL

<u>Sentences</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Feng Chih-lin (馮志林)	Male	33	Hang-chou-shih
	Ch'en Ts-oh'uan (陳大雲)	Male	40	Shao-hsing, Chekiang
	Shih Ting-yu (施定宇)	Male	46	Ch'ung-ming, Kiangsu
	Sun Kung-liang (孫公亮)	Male	32	Hu-yang, Chekiang
	T'ao Yun-feng (陶云峰)	Male	28	Shanghai-shih
	Juan A-mao (阮阿毛)	Male	27	Chu-chi, Chekiang
	Fen Jung-ch'ing (樊榮慶)	Male	32	Yen-ch'eng, Kiangsu
	Hsia P'ing-nen (夏屏南)	Male	33	Ch'ang-shu, Kiangsu
	Li Ming-ch'u (李明渠)	Male	46	Yung-chia, Chekiang
	Tu wen-hao (鄧文浩)	Male	25	Hang-chou-shih
	Li I-chien (李宜堅)	Male	22	Hang-chou-shih
	Chang Wen-pin (張文彬)	Male	39	Chia-hsing, Chekiang
	Chou Hsueh-ch'eng (傅雪成)	Male	42	Hang-chou-shih
	Chao Ts'ung-chun (趙從尊)	Male	54	Hang-chou-shih
	Wu Jung-kao (吳榮高)	Male	40	Tung-yang, Chekiang
	Sun C hin-wen (孫錦文)	Male	28	Hang-chou-shih
	Chang Sung-nien (章松年)	Male	34	Hang-chou-shih
	Chiang Yu-lin (蔣玉琳)	Male	43	Hang-chou-shih
	Ch'ai Tsu-i (蔡祖頤)	Male	56	Shao-hsing, Chekiang
	Chang Ta-min (章達民)	Male	34	Chu-chi, Chekiang
	Kao Chih-Tung (高志東)	Male	32	Hang-hsien
	Han Sung-fa (翰宋法)	Male	46	Hsiao-shan, Chekiang
	Yu Yao-t'ien (俞堯天)	Male	33	Tung-yang, Chekiang
	Ch'ien Sung-yeh (錢頌治)	Male	49	Hang-chou-shih
	Huang Li-chun (黃立俊)	Male	22	Tung-yang, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Wang Yao-chien (王覺乾)	Male	42	Hang-chou-shih
	Chung lien-ken (鍾連根)	Male	28	Shao-hsing, Chekiang
	Yao Jun-liang (姚潤良)	Male	38	Shao-hsing, Chekiang
	Chu C h'eng-kao (朱誠高)	Male	27	Hang-chou-shih
	T'ang Ching-ho (唐靜珂)	Male	38	Hang-chou-shih
	Cheng Chen (鄭 鎮)	Male	42	Shao-hsing, Chekiang
	Wang P'eng-po (王鵬博)	Male	39	Ch'eng-hsien, Chekiang
	Ku Wei-liang (顧維亮)	Male	46	Hai-ning, Chekiang
	Hsu Ch'eng-mu (許成模)	Male	57	Hang-chou-shih
	Pien C hung-yuan (邊中元)	Male	47	Chu-chi, Chekiang
	Yan Shih-te (嚴世德)	Male	42	Chu-chi, Chekiang
	Cheng C h'iao (張 樵)	Male	42	P'ing-tu, Shantung
	Ch'en Yung-hsing (陳永興)	Male	38	Hang-chou-shih
	Ch'in Tzu-yuan (秦子元)	Male	28	Hu-hsi, Kiangsu
	Li Yuan-hsing (李元興)	Male	36	Hang-chou-shih
	Li Hsieh-fei (李燮飛)	Male	31	Anhui
	Ch'ien T'ien-hsueh (錢天雪)	Male	45	Hang-chou-shih
	Pao Chen-heng (鮑震衡)	Male	48	Hsiao-shan, Chekiang
	Hsu Pao-ts'ai (徐寶財)	Male	24	Hsiao-shan, Chekiang
	Hsu hsien-ch'eng (徐顯成)	Male	32	Hang-chou-shih
	Yu lei-sheng (于雷生)	Male	32	Hang-chou-shih
	Chou Chih-chien (周志鑑)	Male	46	Tung-yang, Chekiang
	Chu Chieh-hsi (朱介基)	Male	28	Su-hsien, Kiangsu

CONFIDENTIAL

Sentence

<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
Ch'i Tung-shun (戚永順)	Male	33	Hsiao-shan, Chekiang
Ma I (馬異)	Male	47	Shanghai-shih
Ch'iu Tsu-shou (邱祖綬)	Male	35	Wu-chin, Kiangsu
Sun Wei-Chung (孫衛中)	Male	44	Hunan
Hu Wei (胡衛)	Male	40	Shao-hsing, Chekiang
Wu Wen-sheng (吳萬生)	Male	48	Fu-yang, Chekiang
Hsieh Hui-p'ing (謝懷平)	Male	52	Nen-ling, Anhwei
Kuo P'ei-ch'ing (郭佩卿)	Male	59	Hang-chou-shih
Ch'en C hsi-min (陳嘉敏)	Male	39	T'ien-t'ai, Chekiang
Hsu T'ang (徐端)	Male	37	I-yang, Hunan
Ts'ao Jung-ken (曹榮根)	Male	31	Shao-hsing, Chekiang
Wu Shih-sheng (吳士生)	Male	32	Hang-chou-shih
Wang Ch'i-ying (王奇英)	Male	48	Hsiao-shan, Chekiang
Jen Shu-ming (任淑明)	Male	35	Shao-hsing, Chekiang
Ts'ui Sui-jung (崔經榮)	Male	31	Hang-chou-shih
Ch'en P'ei-jon (陳師傑)	Male	34	Fu-yang, Chekiang
Chiang Yao-lung (蔣耀龍)	Male	42	Shao-hsing, Chekiang
Shih Chien-yun (施劍雲)	Male	34	Hang-chou-shih
Wang Chung-ju (王仲偉)	Male	32	Hang-chou-shih
Wang Chien (王健)	Male	40	Hang-chou-shih
Wang Chien			
Hsu Hsi-k'ang (徐錫康)	Male	33	Shao-hsing, Chekiang
Chang C heng-ch'uan (張政權)	Male	36	Hang-chou-shih
Wang C hih-hsiang (王志向)	Male	29	Hang-chou-shih
Ch'i Ming-hsing (戚明星)	Male	30	Hsiao-shan, Chekiang

CONFIDENTIAL

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Li A-kao (厲阿高)	Male	22	Hsiao-shan, Chekiang
	Fang Tao-sung (方作楠)	Male	34	Ch'uan-chou, Chekiang
	Yang Kuo-chen (楊國楨)	Male	29	H'ui-chiang, Chekiang
	Chu Yuan-k'uei (朱元奎)	Male	40	Hang-chou-shih
	Han A-lung (韓阿龍)	Male	32	Shao-hsing, Chekiang
	Chao Ming-shui (趙明水)	Male	34	Sh'ui-shui, Chekiang
	Chou Wen-jung (周文榮)	Male	30	Shao-hsing, Chekiang
	Li Chin-lin (李錦林)	Male	59	Hang-chou-shih
	T'eng Cheng-ts'ai (唐長財)	Male	43	Hang-chou-shih
	Weng Hui-yuan (王惠元)	Male	45	Shantung
	Shen Yu-ts'ai (沈玉財)	Male	45	T'ai-chou, Kiangsu
	Chou Chien-ch'iu (周劍秋)	Male	46	Hang-chou-shih
	Chang Shou-i (張守義)	Male	35	Han-yang, Honan
	Chiang Shou-ch'ien (蔣壽謙)	Male	52	Shao-hsing, Chekiang
	Ts'ao Jen-t'ing (曹麟亭)	Male	38	Huang-kang, Hupeh
	Li Hui-k'uan (李華寬)	Male	47	Huang-yen, Chekiang
	Yu Chi-chang (俞繼章)	Male	34	Yung-k'ang, Chekiang
	Sung Tao-fu (宋保福)	Male	46	Hang-chou-shih
	Tseng Chu-yang (曾曙揚)	Male	42	Tu-kuei, Szechwan
	Chou T'ien-yu (周天佑)	Male	58	Ju-nan, Hunan
	Hsu Yu-sen (徐雨森)	Male	48	Hang-hsien, Chekiang
	Ch'ien Shih-ting (陳士鼎)	Male	47	Chang-sha, Hunan
	T'ien Ch'ing-chih (譚青直)	Male	30	Si-ch'uan, Hupeh
	Wen Yin-fu (閻陰富)	Male	43	Hang-chou-shih
	Huang Hsi-hsiang (黃錫祥)	Male	30	Hang-chou-shih

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Kao Yung-ken (高永根)	Male	23	Hang-chou-shih
	Yang Fao-lin (楊寶林)	Male	23	Shantung
	Huang Ping (黃炳)	Male	27	Shao-hsing, Chekiang
	Mao Chin-mu (毛金木)	Male	31	Shao-hsing, Chekiang
	Mao Shan (邵山)	Male	40	Shao-hsing, Chekiang
	Wu Jen-fu (吳仁甫)	Male	26	Hang-chou-shih
	Chiang Hsueh-yen (蔣雪恩)	Male	40	Wu-chiang, Kiangsu
	Yang Hsien-k'ang (王前康)	Male	29	Shao-hsing, Chekiang
	Tung Han-shui (董漢水)	Male	30	Hang-chou-shih
	Hsieh Yung-kuei (許永貴)	Male	48	Hu-chiang, Chekiang
	Han Hsi-lin (韓惜林)	Male	52	Hong-chou-shih
	Yu Pao-chiu (余葆秋)	Male	41	Hang-chou-shih
	Wu T'ai-lai (吳泰來)	Male	26	Hang-chou-shih
	Chi Kuo-hua (李國華)	Male	31	Chia-hsing, Chekiang
	Ko Tsung-yuen (葛宗元)	Male	56	Hang-chou-shih
	Cheng K'un-yuan (章坤元)	Male	26	Shao-hsing, Chekiang
	Hsu Pao-lung (許寶龍)	Male	51	Hang-chou-shih
	Chu P'eng-yun (朱鵬雲)	Male	38	Shao-hsing, Chekiang
	Wu Cheng (吳鍾)	Male	35	Tung-yang, Chekiang
	Wang Hung-sen (汪洪森)	Male	37	Hang-chou-shih
	Xuo A-hai (郭阿慈)	Male	32	Hsiao-shan, Chekiang
	Hsi Kao-hui (白高慧)	Male	40	Hsin-teng, Chekiang
	T'ao Mong-hsia (陶孟俠)	Male	33	Li-ling, Hunan
	Ch'ou Shu-li (陳叔利)	Male	33	Hunan
	Yao Po-hua (姚伯華)	Male	45	Canton, Kwangtung

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Ts'ao Fu-yuan (曹福元)	Male	43	I-hsing, Kiangsu
	Chou Chu-chung (周柱中)	Male	35	Hang-chou-shih
	Wu Wen-ts'ung (吴文聰)	Male	54	Hang-chou-shih
	Li Chung-nan (李仲南)	Male	50	Fai-ch'eng, Anhwei
	Jon Kuei-lin (任桂林)	Male	47	Hang-chou-shih
	Mo Chin-piao (莫錦標)	Male	56	Shao-hsing, Chekiang

2 Years imprisonment

Wei Lung-ken (魏龍根)	Male	35	Wu-hsi, Kiangsu
Weng Jih-fa (王日發)	Male	32	Hang-chou-shih
Weng Kuo-ch'eng (汪國成)	Male	43	Chien-te, Chekiang
Li Kuo-chien (厲鵬鑑)	Male	49	Shao-hsing, Chekiang
Hsu Cho-chang (徐琢章)	Male	21	Hang-chou-shih
Han K'un-lin (韓坤林)	Male	38	Hsiao-shan, Chekiang
Kao Yu-ming (高鈺銘)	Male	23	Chia-shun, Chekiang
Ho Hsi-pao (何細寶)	Male	36	Ch'uan-chou, Fukien
Chou Jung-hua (周榮華)	Male	36	Hang-chou-shih
Juan Wei-ch'eng (阮偉成)	Male	43	Yu-yao, Chekiang
Yu Jui-sheng (余瑞生)	Male	51	Shao-hsing, Chekiang
O heng Kuo-jung (鄭國榮)	Male	41	Yung-chia, Chekiang
C h'ien Ho-shang (陳樂山)	Male	48	Shao-hsing, Chekiang
Chia Shui-hsien (賈水賢)	Male	32	Shao-hsing, Chekiang
Shan Te-hsing (單德興)	Male	34	Tientsin,
Ch'ien Chih-hsiang (陳志祥)	Male	32	Heian-chu, Chekiang
Sun Po-ch'i (孫伯岐)	Male	53	Shao-hsing, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Chang Ping-k'um (蔣炳坤)	Male	28	Hang-chou-shih
	Kan Tsu-hsing (于于興)	Male	36	Heiao-shan, Chekiang
	Chang Chih-ping (章志英)	Male	40	Hang-chou-shih
	Sung Yuan-hsing (宋元興)	Male	32	Hang-chou-shih
	Hsiang Mao-jen (相毛人)	Male	40	Hang-chou-shih
	Hung O hua-shan (洪德山)	Male	39	Hang-chou-shih
	Ch'ien Sen-ch'ao (陳森潮)	Male	31	Hang-chou-shih
	T'ao Cheng-jung (陶正榮)	Male	35	Heiao-shan, Chekiang
	Ying I-wei (應一偉)	Male	24	Shao-hsing, Chekiang

1 Years imprisonment

Wang Kuang-hui (王光輝)	Male	35	Szechwan
Ts'ai Yuan-yen (蔡元殷)	Male	19	Shao-hsing, Chekiang
Hsu C hin-ch'eng (徐金成)	Male	28	Hopoh
Chiang Jen-chun (姜仁純)	Male	24	T'ai-chou, Chekiang
Cheng Hsing-nung (鄭鼎農)	Male	19	Shao-hsing, Chekiang
Sun Huan-ch'ung (孫煥中)	Male	26	Jui-an, Chekiang
Fu wei-shan (傅維珊)	Male	19	Shao-hsing, Chekiang
Ho Sheng-chun (何生倫)	Male	33	Chu-chi, Chekiang
Hu Ping-ch'i (吳炳其)	Male	18	Hsien-chu, Chekiang
Mao Han-min (茅漢民)	Male	31	Shao-hsing, Chekiang
Hsu A-tssai (徐阿再)	Male	48	Hang-chou-shih
Hu Shou-fan (胡守凡)	Male	41	Wu-hsing, Chekiang
Chou Chi-Ch'eng (周孝成)	Male	43	Huang-yen, Chekiang
Cheng P'u-yuan (鄭浦元)	Male	29	Tz'u-ch'i, Chekiang
Chiang Kung-mou (蔣功德)	Male	36	Chu-chi, Chekiang

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Wu Chen-tung (吳震東)	Male	39	Hang-chou-shih
	Chou Po-cheng (周伯正)	Male	40	Ch'eng-hsien, Chekiang
	Ch'en Taeng-kuan (陳增官)	Male	32	Hsiao-shan, Chekiang
	Ch'en Kuei-t'ang (陳桂堂)	Male	52	Hang-chou-shih
	Chang Li-ch'un (張利春)	Male	42	Hang-chou-shih
	Ho Tse-shan (何澤珊)	Male	58	Tz'uch'i, Chekiang
Sentenced for 3 years, paroled				
	Shih Tsung-su (石宗素)	Male	72	Hang-chou-shih
Sentenced to be controlled by the masses				
	Yu A-mao (俞阿毛)	Male	39	Hsiao-shan
	Ts'ai P'ei-yun (蔡培雲)	Male	34	Yu-hang
	Li C h'ing-jung (李慶榮)	Male	36	Hang-chou-shih
	Hsieh Tso-ken (謝佐根)	Male	48	Hang-chou
	Kao Yu-hsien (高華先)	Male	29	Hang-chou
	C h'ien Ch'uan-chung (陳傳忠)	Male	30	Shao-hsing
	Li Ping-jung (李炳榮)	Male	43	I-wu
	Chao i-min (趙益民)	Male	50	Su-hsien, Anhwei
	Yeh Hsiao-feng (葉孝豐)	Male	33	Hang-chou
	Ho Chang-hai (何長海)	Male	39	Chu-chi
	Chu Po-jui (朱伯瑞)	Male	25	Shao-hsing
	Shan Shuang-ch'uan (單雙泉)	Male	32	Shao-hsing
	Hsu C hin-hua (徐金華)	Male	25	Hang-chou
	Chiang Tung-tao (蔣宥道)	Male	34	Tung-yang
	Chang Yao-hua (張耀華)	Male	32	Hang-chou

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Yang Tzu-yun (楊子云)	Male	40	Ning-po
	Ch'en A-tung (陳阿冬)	Male	31	Hang-chou
	Hsieh C hin-shui (夏金水)	Male	39	Hang-chou
	Shu Chung-hua (舒仲華)	Male	33	Hang-chou
	C hin Hsin (金鑫)	Male	44	Shao-hsing
	Ts'ao Kuo-kuang (曹國光)	Male	40	Hang-chou
	Hsiao Chih-pin (蕭質彬)	Male	41	Kan-chou, Kiangsi
	Huang Kuo-hsiung (黃國雄)	Male	37	Hang-chou
	C h'ang Pen-tuan (陳本端)	Male	40	Yu-shen, Kiangsi
	Ch'en C hieh-ch'ien (陳傑龍)	Male	35	Hsin-wu, Honan
	Hsiang Hsi-ch'ing (向錫卿)	Male	32	Hsiang-t'ien, Hunan
	Woo Y ung-ch'ao (吳永潮)	Male	18	Hang-chou
	Ch'en Ch'i-shih (陳職氏)	Female	42	Hsiao-shan,
	Hsu Jui-t'ang (徐瑞棠)	Male	45	Hsiao-shan
	Shao shun-chi (邵順記)	Male	55	Hang-chou
	Chiang Te-sheng (蔣德盛)	Male	37	Hang-chou
	Wang Yu-ming (王毓明)	Male	36	Hang-chou
	Hsien Yu-ch'uan (許育泉)	Male	35	Hang-chou
	Yao Ch'eng-fa (姚成法)	Male	54	Hsiao-shan
	Wang Lai-fa (王來法)	Male	37	Hang-chou
	Teng Te-ming (滕德明)	Male	27	Ch'ung-ning, Kiangsu

CONFIDENTIAL

<u>Sentence</u>	<u>Name</u>	<u>Sex</u>	<u>Age</u>	<u>Native Origin</u>
	Wang Lai-fa (汪來法)	Male	36	Hang-chou
	Yang Hui (楊惠)	Male	29	Li-ch'eng, Shantung
	Ko Chang-chang (柯樟章)	Male	36	Tu-chou, Fukien
	Hsia Min-sheng (夏敏生)	Male	45	Hang-chou
	Hsu Chin-mao (徐金茂)	Male	42	Shao-hsing
	Chu Chien-hsun (朱建勳)	Male	42	T'ai-hsing, Kiangsu
	Chung chin-jung (鍾金榮)	Male	29	Shao-hsing
	Lai Tung-liang (賴棟梁)	Male	41	Chi-nan, Shantung
Released on bail		surety		
	C hang Kuo-ch'i (張國祚)	Male	42	Shao-hsing
	Yang C hih-hua (楊志華)	Male	35	Yang-chou, Kiangsu
	Lai Shien-fu (薛連福)	Male	73	Hang-chou
	Hsu Wen-hua (徐文華)	Male	39	Hai-ning

50X1-HUM

CONFIDENTIAL

C I A

FOREIGN DOCUMENTS DIVISION

24 Oct 1951

50X1-HUM

Theory of filtration in intermedium migration as
determined by interaction of intermedium pattern of
several layers

Volodya Skadovskiy, 1950, Volume XXV, no 3, pages
111-114, 21 November 1950, M. K. Gribunsky; Moscow

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL

PROBLEMS OF SUBTERRANEAN EXCAVATION AS A RESULT OF WATER

ACT 2. SUBTERRANEAN WATER IN SEVERAL LAYERS

Academician D. N. Polyanski, 16 Sept. 1950

Hydrogeology ...

hydrogeology of a number of the most difficult regions to exploit which contain very important mineral deposits in USSR is characterized by the following conditions: 1) mineral deposits are situated in the water-bearing strata (see drawing 1), which consists of loose and porous water-bearing sands, silty clays, conglomerates, etc.) and also water-permeable clays, sand clays, etc.) layers, resting on a solid crystalline base, or on a thick stratum of water-tight clays, and in direct contact with the bottom of the water-bearing layer of the entire stratum; 2) they are a free space in the upper part of the water-bearing stratum; and 3) the depth of the water-bearing stratum is not far from the natural level of subterranean waters is considerably greater than the amplitude of variation of this level and is considerable here in the exploitation of the region (the second part of the last condition is satisfied only in the case where there is a river or brook present in the region of the deposit, the waters of which can replenish the subterranean waters as their level is lowered). These regions of deposits, in view of their difficulty of exploitation due to flooding, require special attention on the part of hydrogeologists and hydraulicists. A study of water inflow into subterranean excavations (above-mentioned conditions presents a complex problem, which at present can be solved by a complex method consisting in the solution by hydraulic methods of the problem of water inflow into a round completed excavation (by com-

*Drawing 1 in the Appendix

- 1 -

CONFIDENTIAL

CONFIDENTIAL

plated excavation is meant an excavation cutting through the entire water permeable layer); transition from a round completed excavation to an incomplete infiltration from a round excavation is accomplished by engineering methods. (Applicable to a stratum consisting of 3 layers these engineering methods and consideration of partial division of the geologic infiltration -- as indicated below -- are discussed in paper 3.)

Solution of the hydraulic portion of this problem is facilitated by the following:

- (1) in view of the third above-stated condition the subterranean water level in the upper layer of the stratum can be regarded as being constant and horizontal, and
- (2) according to the experimental data (2) which agree with the analytical data of field materials (2), we can assume a simplified filtration stream for the studied conditions, the character of which is as follows: in water-permeable layers we neglect the vertical component of filtration velocity, and, for layers of small water-permeability situated between water-permeable layers, we neglect the horizontal component of filtration velocity. In this connection we deal with steady-state filtration in a stratum beyond the contour of a plan view excavation with the following conditions: (1) excavation is completely round, (2) the above-described stratum is symmetrical relative to the axis of excavation, (3) thickness of the mineral deposit (as it usually happens with subterranean excavations) is considerably less than the thickness of the entire stratum.

The studied filtration stream is obviously symmetrical relative to the axis of the excavation. In its investigation, in view of the

CONFIDENTIAL

CONFIDENTIAL

tant of the above stipulated conditions, it is not necessary to consider partial draining of geological formation in the vicinity of the excavation.

We subdivide the stratum through which filtration takes place by means of cylindrical surfaces concentric with the excavation into such regions that, within the limits of their thickness, filtration coefficients of each of the layers can be regarded as constant. These surfaces (for the selected piece of stratum) divide the limits of water-permeable layers can be regarded as equipressure surfaces, and within the limits of layers of small water permeability (located between water-permeable layers) they can be regarded as surfaces of flow. Let us estimate filtration within thus subdivided regions.

Let us define within water-bearing stratum a rectangular element $dx \cdot dy$ and a section from the bottom of the top water- or cable layer to the bottom of the lower water-permeable layer (drawn in Fig. 1). Setting up the steady-state continuity equations for the two lower layers, for lower layers, etc., and adding, up to the upper k th water-permeable layer we get:

$$\begin{aligned} \nabla^2 u_{k+1} &= - (u_k - s_{k+1}) \\ c_{k+1} (u_{k+1} - u_k) &= c_{k+2} (u_{k+2} - u_{k+1}), \\ &\dots \dots \dots \\ c_{2n-2} (u_{2n-2} - u_{2n-3}) &= c_{2n-1} (u_{2n-1} - u_{2n-2}), \\ c_{1n-1} u_{1n-1} + c_{2n-2} (u_{2n-2} - u_{2n-3}) &= c_{2n-1} u_{2n-1} - c_{1n} s_1 \end{aligned} \quad (1)$$

where $s_1, s_2, \dots, s_n$ are the differences between constant pressure on the top water-permeable layer of the stratum and pressures of the remaining water-permeable layers; $c_n = k_{n+1} b_{n+1} / (a_n k_{n+1} / a_n)$;

CONFIDENTIAL

1. *Chlorophyll a* (Chl a) is the primary photosynthetic pigment in most plants and algae. It is a green pigment that absorbs light energy in the blue and red regions of the visible spectrum. Chl a is essential for the light-dependent reactions of photosynthesis, where it converts light energy into chemical energy.

 α_1, α_2 are absorption and scattering coefficients of water in
 nable layers; $\alpha_1, \alpha_2 = 1$ are optical loss water-per mille layers.

Let us note that water inflow from surfs above the excavation and below the excavation constitutes a small portion of the total water inflow into the excavation.

So multiply the third equation of a system (1) by γ , the second by μ . . . , next to last by λ and the last by ν . Adding the results,

we get:

$$f(x) = f_0(x) + f_1(x) + \dots + f_{n-1}(x) + f_n(x) = \left(\frac{1}{2} + \frac{1}{2} \right) + \left(\frac{1}{2} + \frac{1}{2} \right) + \dots + \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{n}{2} + \frac{n}{2} = n$$

$\frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx = \frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx$

is in equation (2) to get

100-443887-100

$$P_{\text{eff}} = P \left(1 - \frac{\alpha}{\beta} \right) \quad (3)$$

[Faint handwritten notes at the bottom of the page]

equation (2) will become:

$$\bar{V}^{-1}(E, \epsilon, k, \epsilon_0, \epsilon_1, \epsilon_2, \epsilon_3) = (\bar{E}, \bar{\epsilon}, \bar{k}, \bar{\epsilon}_0, \bar{\epsilon}_1, \bar{\epsilon}_2, \bar{\epsilon}_3), \quad (4)$$

where $F_1, F_2, \dots$ are constants, which are functions of $\alpha, \beta, \dots, \lambda, \mu, \dots$.

System (3) is homogeneous with respect to $\lambda, \mu, \dots, \nu$, and in order for it to have one solution, the following relationship must hold:

CONFIDENTIAL

(5)

$$f(x) = \frac{1}{2} \left(\frac{1}{x} + \frac{1}{x^2} \right) \quad (6)$$
$$q = \sum_{j=0}^{\infty} q_j(t) e^{-(\lambda_1 + j)\tau} + h_0(t) e^{-\lambda_1 \tau}. \quad (7)$$

- 3 -

CONFIDENTIAL

CONFIDENTIAL

Since the cross-sectional flow through any of the water permeable layers is equal to (5)

$$Q = 2\pi r b k_1 \frac{dh}{dr}, \quad (6)$$

from expression (7) we get:

$$Q_1 = 2\pi r b k_{11} \cdot \sum_{n=1}^{\infty} \frac{1}{n} \sqrt{\sigma_n} \left[-A_{1n} I_1(r/\sigma_n) - B_{1n} K_1(r/\sigma_n) \right], \quad (8)$$

$$Q_2 = 2\pi r b k_{12} \cdot \sum_{n=1}^{\infty} \frac{1}{n} \sqrt{\sigma_n} \left[-A_{2n} I_1(r/\sigma_n) + B_{2n} K_1(r/\sigma_n) \right],$$

.....

If in the waterbearing stratum situated beyond the contour of the excavation there are distinguished p regions, then their filtration equations have $2ap$ constants. To determine the latter we solve: (1) over separate regional surfaces $n(p-1)$ equations of discharge and $n(p-1)$ equalities $\sigma_n = \sigma$, and (2) at the peripheral portion of the contour of the stratum there are p boundary conditions. The boundary equations are set up on the basis of conditions at the boundary of a given layer and the excavation and waterbearing strata above and below the excavation/stratum. With formula (7) it is not difficult to determine a and b in cross-sections of less water-permeable layers.

The All-Union Scientific-Research Institute of Hydrogeology and Engineering Geology.

Received 20 July 1950

[Signature]

CONFIDENTIAL

CONFIDENTIAL

LITERATURE

1. N. E. Girsinskiy. Institute of filtration underneath hydrotechnical technical structures on non-homogeneous soil, 1941.
2. N. E. Girsinskiy. Hydro geology and engineering geology, symposium No 9, 1947.
3. N. E. Girsinskiy. Problems of hydro geology and engineering geology, symposium No 10, 1950.
4. A. S. Izraeliyev, Proceedings AN USSR SRN, No 9, 1947.
5. P. Ya. Volokharina-Tochina, Applied Mathematics and Mechanics No 1, 1947.

50X1-HUM

RESTRICTED

C I A

FOREIGN DOCUMENTS DIVISION

24 Oct 1951

50X1-HUM

Table of Contents of the Soviet Periodical
"Journal of Physical Chemistry"

Zhurnal Fizicheskoy Khimii,
No 1-4, 1942

**[This report has not been edited or
prepared for publication]**

RESTRICTED

RESTRICTED

TABLE OF CONTENTS of the Soviet Periodical "JOURNAL OF PHYSICAL CHEMISTRY"

Vol XVI, Nos 1-2, 1942

"Electronegraphic Determination of the Structure of Cadmium Bromide"

Z. G. Pinsker

Biogeochemical Laboratory

Academy of Sciences USSR

Received 23 April 1941

"Electrochemical Determination of the Thermodynamic Constants of Oxides
of Certain Metals"

I. A. Makolkin

Academy of Sciences Ukrainian SSR

Institute of Physical Chemistry imeni L. V. Pisarzhevskiy

Department of the Chemistry of Isotopes

Received 14 April 1941

"Determining the Thermodynamic Constants of Sulfides of Mercury and Silver
from Electromotive Forces"

I. A. Makolkin

Academy of Sciences Ukrainian SSR

Institute of Physical Chemistry imeni L. V. Pisarzhevskiy

Department of the Chemistry of Isotopes

Received 14 April 1941

"The Viscosity of Borax and Boric Anhydride in the Interval of Softening"

B. V. Rabinovich

Received 3 February 1941

^{Protein}
"Research on the Electrochemistry of-Albumens -- IX. The Exchange
Adsorption of Neutral Salts on Gelatine"

A. Pasynskiy and Z. Zolotareva

- 1 -

RESTRICTED

RESTRICTED

Received 26 May 1941

Franklin
"Research on the Electrochemistry of Albumens -- XII. The Influence of
the Ion Strength of the Solution on the Electrochemical Proper-
ties of Albumens"

A. Pasynskiy

Received 26 April 1941

"The Coagulation of Hydrophobic Sols with Mixtures of Electrolytes --
VI. The Theory of a Double Electric Layer"

L. Lepin' and A. Bromberg

Received 18 December 1940

"The Problem of the Mechanism of the Action of Collectors in Flotation
XIII"

M. Ye. Lipets

Colloidal-Electrochemical Institute

Academy of Sciences USSR

Laboratory of the Physico-Chemistry of Dispersion Systems

Received 28 February 1941

Vol XVI, Nos 3-4, 1942

Swan
"Aromatic Nitro Compounds, as Acids and Acid-Like Substances in Liquid
Ammonia"

A. I. ^{Sh}Atenshteyn and Ye. A. Izrailevich

Moscow

Physico-Chemical Institute imeni L. Ya. Karpov

Laboratory of ^{Non-aqueous} Anhydrous Solutions

Received 26 April 1941

- 2 -

RESTRICTED

RESTRICTED

"Dipole Moments of Certain Complex Compounds of Aluminum Bromide"

I. A. Sheka

Kiev

Institute of Chemistry, Academy of Sciences Ukrainian SSR

Received 13 February 1941

"A Study of Polymers -- 7. The Depolymerisation of Linear Polymers"

A. Votinov, P. Kobeko, F. Marey

Leningrad

Physico-Technical Institute

Laboratory of the Chemical Properties of Polymers

Received 14 April 1941

"Exchange Adsorption on Sols of Silver Iodide"

V. A. Kargin and M. A. Tolstaya

Moscow

Physico-Chemical Institute imeni L. Ya Karpov

Laboratory of Colloidal Chemistry

Received 28 April 1941

"On Full and Surplus Exchanges of Free Energy in the Formation of Liquid
Mixtures and Solutions"

V. A. Kireyev

Moscow

All-Union Scientific-Research Chemico-Pharmaceutical Institute

Physico-Chemical Laboratory

Received 24 May 1941

"On the Reciprocal Solubility of Liquids"

V. A. Kireyev

Moscow

- 3 -

RESTRICTED

RESTRICTED

All-Union Scientific-Research Chemico-Pharmaceutical Institute

Physico-Chemical Laboratory

Received 24 May 1941

"The Solubility of Argon in Liquid Oxygen"

V. G. Fastovskiy and Yu. A. Krestinskiy

Moscow

All-Union ^{Electroengineering} ~~Electrotechnical~~ Institute

Received 24 April 1941

- 4 -

RESTRICTED

50X1-HUM

~~RESTRICTED~~
~~UNCLASSIFIED~~

C I A

22 Oct 1951

50X1-HUM

50X1-HUM

Norwegian - Soviet Boundary

Part II of Two Parts

Two booklets totalling 56 pages,
Oslo, 1948.

This report has not been edited
or prepared for publication.

~~RESTRICTED~~
~~UNCLASSIFIED~~

1. Original map in the scale of 1:25,000 with the boundary line and the boundary markers indicated.
2. Sketch of the geodetic net.
3. Descriptive protocol, with attachments, of the course of the international boundary.
4. Protocol for each individual boundary marker, with sketch outlines and photographs on the back page.

In the First Subcommittee's sector, 172 boundary markers were set up, and in the Second Subcommittee's sector, 243 boundary markers (that is, a total of 415 boundary markers in which are included the alignment markers in the mouth of the Grense Jakobselv River and 25 stone cairns).

The Joint Commission's check of the completed work took place from 1st to 3 September and was undertaken by special committees, one for each boundary sector. In each committee two members from each of the two Delegations in the Joint Commission took part.

The check was accomplished by a series of tests in the field by the marking and charting workers, as well as by an examination of the documents already set up.

In the protocol on the last boundary meeting of the Commission, 4 September 1947, it was established that the Joint Commission, by checking the work in the field which the Joint Subcommissions had carried out, could declare that the marking and charting of the Norwegian-Soviet common boundary was accomplished in the established time and corresponded with the technical instructions which the Joint Commission had prepared (Meeting Protocol No 27).

Placement of the Boundary

The basis for the establishment of the boundary was agreed to during the negotiations of the joint Commission in Moscow in the fall of 1946 and in Oslo in March 1947. During the meetings in Oslo there were further established more closely definitive policies for the drawing of the boundary where it followed the Pasvikelv and Grense Jakobselv waterways.

During the actual boundary survey, the principles which were adopted for the establishment of the boundary were followed so far as it was technically possible. As presumed during the discussions of the Joint Commission's Regulation, exact measurement with modern instruments, as now was the case, necessarily entailed the making of slight deviations from the previous boundary line in certain instances, as provided by Article II, second paragraph, of the Regulation, which made it possible for the Commission to undertake minor regulation of the boundary in certain cases where it might prove expedient "with regard to the local conditions."

The following is an account of those cases where questions arose on such regulations:

(a) Alteration proposal, as authorized by Article II, second paragraph, of the Regulations

In the meeting of the Joint Commission on 30 June 1947, a proposal was submitted by the Soviets on the revision of the boundary at Skoltefoss Falls. The Soviet party raised the question of transfer to the Soviet Union of a triangular area of approximately 103 maals [one maal equals 0.25 acres] on the Norwegian side of the Pasvikelv, south of the main falls at Skoltefoss, in order to obtain their own ferry site between both Soviet shores at the neck of the falls. They offered in compensation for this an area of approximately the same size (about 113 maals) on the north side of the Boris Glib polygon between the old national cairns No 359 and No 360.

The Norwegian Delegation found, however, that it could not discuss this exchange proposal, since Norway had a profound economic and technical interest in just that area at Skoltefoss Falls with which the proposal dealt, especially in connection with a possible damming of the Skoltefoss Falls. Since a part of the drop of the falls belonged to Norway, the Norwegian Delegation desired to see the question as a part of a larger affair, namely the possible damming of the waterpower in the entire Pasvik waterway.

In regard to this, the Joint Commission agreed to let the proposal on an adjustment of the boundary, as mentioned, be dropped from the agenda.

During the meeting of the Joint Commission on 30 June 1947, a proposal was submitted by the Soviets on the revision of the boundary at Grensefoss Falls in the Pasvikelv River. The boundary line goes in over land on the southern (right) side of the river, such that two small areas together amounting to about 32,000 square meters on the right river bank are Norwegian, and goes from there out into Grensevatn. At Grensefoss Falls both river banks belong to Norway.

The proposal was motivated by the fact that the Soviet party was cut off from using the river for boat traffic and floatage through Grensefoss for the above reasons. The Soviet Delegation therefore proposed that the boundary be revised so that the boundary line would also follow the thalweg of the river at Grensefoss Falls.

The Norwegian Delegation stated that the course of the boundary line at Grensefoss Falls had been expressly established in this fashion by the Agreement of 1826 and that it was not within the mandate of the Joint Commission to deviate from that boundary line which was a result of the Agreement. Actually the Norwegians stated that the problem at Grensefoss Falls was tied up with questions of a technical nature regarding dams, and that naturally these questions would have to be solved in connection with the other problems on the utilization of the total water power in the Pasvik waterway.

The Joint Commission then agreed to suspend further negotiations on this question as well.

(b) Alteration Proposals as a Result of Thalweg Surveying

During the First Subcommittee's determination of the course of the boundary line in the Pasvik waterway, further questions were raised on regulation of the boundary at the following places:

1. At Kisteholmen Island -- Riitasaari (two small islands in Lake Pjaervatn north of Nyrud),
2. At Skolteholmen Island (called Nakholmen on the previous boundary map) -- Gravholmen Island in Lake Vaggatemvatnet,
3. Brennholmen Island -- and an unnamed little island in the Vaggatemstryk Rapids,

4. At Nivasaari (written Nivansaari on the previous boundary map) -- between the Steinstrykene and Ulvestrykene Rapids.

1. The boundary line at Kisteholmen -- Riitasaari in Lake Fjaervatn had since 1826 lain between these islands so that Kisteholmen Island the area of which is ca. 144,500 square meters, was Norwegian territory, while Riitasaari belonged to the Soviet Union. However, with the Subcommission's thalweg measuring, it was ascertained that the deepest part of the river did not go between the islands but rather west of them so that consequently Kisteholmen Island should be transferred from Norwegian to Soviet sovereignty.

The Norwegian delegation in the First Subcommission had, on the basis of the measurements taken, declared itself in agreement that Kisteholmen Island, as a result of the thalweg rule, would fall to the Soviet Union, but it at the definitely stipulated that the thalweg principle be followed in the same manner throughout the remainder of the marking of the river boundary. This condition was applied with special regard to the conditions at Skolteholmen Island and Nivasaari.

2. At the marking of the boundary in the area of Skolteholmen Island -- Gravholmen Island in Lake Vaggatemvatnet, a difference of opinion arose between the two delegations in the First Subcommission. The boundary passed here between the islands so that the little island of Gravholmen lay on the Norwegian side, west of the boundary line, while Skolteholmen Island, the area of which is 500,000 square meters, belonged to the Soviet Union. The main stream goes east of Skolteholmen Island, while the course between the islands is very shallow and the constant shifting in the river bed could cause them to join together. The Norwegian delegation maintained, therefore, that the boundary at this place would have to be relocated so that both parties had a navigable course on the east side of Skolteholmen Island. This island would thereby be transferred from Soviet to Norwegian sovereignty. This standpoint was based on the resolution in the Joint Commission's Meeting Protocol No 10, II, point 3, that the boundary was to follow the thalweg in lakes, even when the boundary goes between islands.

The Soviet delegation objected that there was passage for both parties as the boundary now stood, between the islands, and that in any case there could be no talk of changing the boundary with regard to protocol 10, II, point 3, since this would mean that the boundary line would not go "between islands" but between one island, Skoltsholmen, and the Soviet mainland. The Soviet party maintained besides that it was not even proven that the deepest course is east of Skoltsholmen.

Agreement was not reached in the Subcommittee on this question which was thereupon referred for settlement to the Joint Commission.

3-4. At the island of Nivasaari, north of the Vaggatemyrky Rapids, the Pasvikelv River divides into a western course -- Steinstrykene Rapids, and an eastern course -- Ulvestrykene Rapids. The western course, where the boundary goes, has a continuous water flow only during flood times and offers no possibilities for navigation or floatage. The eastern course has by far the greater part of the river's volume of flow, it is navigable, and timber floatage has always been conducted on this branch.

During the boundary survey of 1896, the boundary commissioners ascertained and recorded that "the western branch was not as deep as the eastern branch, and from information gathered from the local inhabitants, it becomes nearly dry at low water level." Since 1826, however, the boundary line had been established at the dried-up western channel, and it was not altered in 1896.

The First Subcommittee protocolled, after undertaking a survey trip that "after a conscientious investigation" of the two courses, it was established that the river was dried up in a number of places in Steinstrykene Rapids. "The thalweg determined in the Pasvikelv River goes east of Nivasaari and this fact is laid as the basis for this settlement." Both parties in the Subcommittee were in agreement that the boundary ought to be altered and moved over from Steinstrykene Rapids to Ulvestrykene Rapids. Nivasaari, the area of which is approximately 292,000 square meters, would, as a result thereof, be transferred from Soviet to Norwegian sovereignty.

At the same time the Soviet party brought up the matter of a corresponding regulation of the boundary a little further south in the Pasvikelv River, at

Brennholmen Island, and at another little-known island in Vaggatemstryket Rapids. (The total area of these two islands is approximately 40,000 square meters). The thalweg soundings undertaken showed that the deepest course is west of the islands, while the boundary line goes on the east side. According to the thalweg principle, the boundary should therefore be relocated in the western course, where the Soviet Union would obtain the sovereignty over these two small islands. Both parties were in agreement on this, and the Subcommissions therefore reached the decision to correct the boundary's course both at the island in Vaggatemstryket Rapids, at Brennholmen Island, and at Nivasaari Island.

By discussions in the First Subcommission, the boundary was temporarily established in the following manner:

Kisteholmen Island, Brennholmen Island, as well as the islands in Vaggatemstryket Rapids were to be transferred to Soviet sovereignty, while Norway was to have half of the important passage on the east side of Nivasaari Island and thereby the sovereignty of this island.

All of the settlements by the Subcommission were, however, to be submitted to the Joint Commission for approval, in accordance with the instructions. In addition, the Joint Commission had to settle the question of possible regulation of the boundary at Skolteholmen Island where agreement had not been reached by the Subcommission.

The first meeting of the Joint Commission to discuss these questions took place on 15 July 1947. The Soviet Delegation reasserted the demand which had been set forth by the Soviets in the First Subcommission, a transfer to the Soviet Union of Kisteholmen Island, Brennholmen Island, and the island in Vaggatemstryket Rapids. The Norwegian demand on the shifting of the boundary line at Skolteholmen Island was, on the other hand, refused, and they made the transfer at Nivasaari Island contingent upon the approachability of the Norwegian Delegation concerning the previously discussed matter of the regulation of the boundary in the Grensefoss area.

The Norwegian Delegation precisely defined the fundamental difference between a correction of the boundary line on the basis of the thalweg measurements

where the Agreement of 1826 had employed the thalweg principle, and a revision of the boundary line to correspond with the thalweg in a place where the Agreement of 1826 had employed another principle. The delegation had to insist that under no circumstances could it consent to any boundary revision at Grensefoss Falls, even as a part of a possible mutual exchange arrangement.

In regard to the remaining questions, the Delegation pointed to the viewpoints which were maintained by the Norwegian party in the First Subcommittee, concluding that the Norwegians were willing to carry through the thalweg principle consistently in those places where this principle, according to the instructions in effect, was to be employed, namely at Kisteholmen Island, Skolteholmen Island, Brennholmen, in Vaggatemstryket Rapids, and at Nivasaari Island.

The meeting did not result in any solution to the controversial questions. The Commission therefore decided to study the questions more closely and to discuss them finally in a later meeting. This new meeting took place on 18 July 1947. The Norwegian Delegation presented a sketch in the scale of 1:10,000 of the area at Skolteholmen Island -- Gravholmen Island. The sketch was superinduced on the exact depth measurements in several profiles, which clearly showed that the deepest channel ran east of both islands.

During the discussions, the Soviet Delegation maintained its previous standpoint that a possible cession to Norway of Nivasaari Island was contingent upon Norway's yielding to the Soviet demands for revision at Grensefoss Falls. The Soviet Delegation was not willing to alter its previous stand concerning Skolteholmen Island either. As a result of this, the Norwegian Delegation could not consent to a transfer of Kisteholmen Island, Brennholmen Island, and the islands in Vaggatemstryket Rapids to the Soviet Union -- a transfer which the Norwegians right from the beginning had made conditional upon a consistent application of the thalweg principle wherever the boundary followed a river (or passed between islands in a waterway). None of the boundary alterations proposals by the Subcommittees could be agreed upon by the Joint Commission, and therefore, the boundary had to be established in all these places to correspond

to the previous boundary line as it had been marked on the maps of 1896.

(c) The Course of the Boundary in Lakes Klistervatn and Fossevatn.

The strip of boundary from the division of the sectors at 69 degrees 32 minutes north latitude to Skoltefossen Falls in the Pasvikelv River comprises the water area Klistervatn-Fossevatn which most closely resembles a calm, very wide, and very slow-moving river.

The Norwegian Delegation in the Second Subcommittee had comprehensive thalweg surveying undertaken in the area and ascertained thereby that the channel made a series of sharp turns apparently without relation to the water contour along the banks. The Delegation proposed, therefore, that the area be considered a lake and that the boundary line in principle be drawn to correspond to the maps of 1896. But since these maps are not particularly accurate, the Norwegian Delegation proposed certain corrections in the boundary line as per a sketch presented at the time before the Soviet party in the Subcommittee.

The Soviet Delegation agreed to consider the area as a lake but maintained that the boundary line should then be laid to correspond with Article II of the Convention of 1826, namely on the middle line, and not as indicated on the submitted sketch.

The question was discussed at the meeting of the Joint Commission on 17 July 1947. The Soviet Delegation desired in this instance to tie the settlement in with the other unsolved questions along the Pasvikelv River -- Grensefoss Falls, among other things. Since, however, the matter of boundary regulation in Lakes Klistervatn and Fossevatn was only a purely technical question, with little real significance to either of the parties, the Norwegian Delegation preferred an immediate settlement. It was also agreed that the boundary line should be retained there as it was drawn on the map of 1896 without any of the proposed corrections.

(d) The Course of the Boundary in the Mouth of the Grense Jakobselv River at the Entrance to Grense Jakobselv

Toward the end of the boundary marking, a difference of opinion arose

in the Second Subcommittee as to how the boundary was to be placed at the mouth of the Grense Jakobselv River. The Norwegian delegation maintained that here, as everywhere else in the river, the thalweg should form the boundary. The Soviet delegation maintained for its part that the boundary in the mouth and at the entrance to the river had to be drawn to correspond with the maps of 1896 (especially a cairn map, "sheet Jakobselv," of the then existing National Cairn No 363, in the scale of 1:8,400).

A boundary placement as urged by the Soviet delegation would, however, mean that the Norwegian inhabitants in the Grense Jakobselv Valley would not be able to use the harbor inside the river mouth. At low water level and during storms, they would also be cut off from free access to the river mouth from the sea because of the large sand bank on the Norwegian side outside the mouth.

When the question was not solved in the Subcommittee, it was referred to the Joint Commission for settlement.

The Commission's first meeting on this question took place on 4 August 1947. The Norwegian Delegation emphasized the demand that the thalweg principle also be followed in the mouth of the Grense Jakobselv River. Drawing up the boundary on the basis of the 1896 maps, just as the thalweg was then, would mean that the Norwegian inhabitants would be deprived of free entrance to the river, a right they had exercised by virtue of Norwegian sovereignty without objection from anyone in the nearly 100 years during which the Grense Jakobselv valley had been inhabited.

The Soviet Delegation maintained for its part that during the discussions on the Grensefoss region, it had itself proposed that the thalweg be the boundary between the two countries everywhere, but at that time this had been declined by the Norwegian party. It would naturally follow then that all disputes concerning the establishment of the boundary would be settled on the basis of the maps from 1896.

After a thorough discussion, the Soviet Delegation agreed to undertake a joint inspection of the mouth of the Grense Jakobselv in order to study the conditions there. This inspection took place on 8 August 1947.

The Norwegian Delegation had in this connection allowed a provisional marking of the boundary line to be made such as it now would be if the maps of 1896 were to be followed. This marking showed very clearly the unfortunate consequences such a boundary line would have on the interests of the Norwegian inhabitants in the Grense Jakobselv Valley. During the inspection, it was further ascertained by the test measurements that both the main map and the cairn map of 1896 were very inaccurate.

The result of the inspection was discussed at the meeting of the Commission on 12 August 1947. Referring to the fact that the inaccurate maps of 1896 formed no valid basis for drawing the boundary in the mouth of the river, the Norwegian Delegation maintained that according to the given regulation, the Commission was obligated to seek a solution from the Agreement of 1826 which in Article 2 prescribes that "Every place where the Pasvig and Jacobselv Rivers form the boundary between Norway and Russia, the thalweg in these waterways is to serve as the boundary line."

After a rather long discussion, the result was that the Soviet Delegation consented to the boundary line in the Grense Jakobselv mouth, as drawn according to the proposal of the Norwegian Delegation, and to the establishment of the entrance boundary from the sea such that both parties obtained a navigable course into the river mouth.

Exact placement of the entrance boundary was turned over to the experts of the two parties. The experts later made a proposal on the entrance boundary, which with certain changes was approved by the Joint Commission on 15 August (cf. attachment to the Meeting Protocol No 25). In return, the Norwegian Delegation consented to cede to the USSR Kistoholmen Island, Brennholmen Island, and the unnamed island in Vaggatemstryket Rapids, while the Soviet Delegation waived its demand for a revision of the boundary at Grensefoss falls.

This solution was the best compromise which could be reached under the existing circumstances. For the Norwegian part, it appeared important that the population in Grense Jakobselv be ensured a boundary line which guaranteed access to fishing and navigation in the river mouth. Three

relatively worthless small islands in the Pasvik waterway were offered as compensation. Every one of the adjustments were made on the basis of the thalweg principle; with regard to the conditions at Nivasaari Island, it was expressly established in Meeting Protocol No 21, I, that the point concerned in that draft which was later to be submitted for agreement regarding boundary regulation "in the interests of both parties, is to provide for common utilization of the navigation channel."

The boundary between the sea territory of the two countries was not established during the negotiations of the Joint Commission. The question was made the subject of certain preliminary discussions, but when common ground was not reached, the Commission felt -- in view of the forthcoming conclusion of the field work -- that it should not take up further negotiations on this question (see Meeting Protocol No 24, IIB and No 25, II).

The Joint Commission held its last meeting at the boundary on 4 September 1947 and pronounced all the field work completed and approved. At the same time, however, it was noted that when the Commission was to correlate the material from the material from the two different Subcommissions, it would be necessary to make certain "minor editorial corrections" in certain of the prepared boundary-marking protocols on the course of the boundary. These corrections were to be made during the editing of the material by the Commission in Moscow later on, and it was agreed that a meeting should take place in Moscow as soon as possible in order that the final paper work might get under way.

11. Negotiations in Moscow, September 1947 - January 1948

The Norwegian Delegation returned to Oslo from Finnmark on 11 September 1947. The short stay there was used for conferences with the interested technical authorities; likewise, the necessary arrangements were made with regard to the various kinds of technical work, drafting for reproduction of original maps, diagrams, and rough sketches, etc.), to be done by the Norwegian Geographic Survey. The Delegation proceeded immediately thereafter to Moscow. In addition to the Delegation with its secretaries, interpreters,

and office girls, the following five of the experts from the boundary survey participated in the final work in Moscow: Professor of Geodesy, Dr Tor Eika; Section Chief in the NGO Norwegian Geographic Survey Major N. Sire; Astronomer in the NGO, Lieutenant O. Tajet. After the specific geodetic duties were completed, Professor Eika returned to Norway on 22 October, whereas the remaining experts could not return before 17 December.

The work of editing was initiated by an official meeting of the Joint Commission on 27 September. Only four official meeting protocols were submitted from these negotiations in Moscow during the fall of 1947.

Actually during these negotiations frequent meetings were held by the Commission; likewise, the various professional groups of the delegates and experts coordinated and conferred daily. The technical work of both delegations took place in offices which were on the same floor in the same building. The Commission decided, however, to confine the official protocolling to those to those meetings in which rather important agreements of a fundamental nature were made. This was done in view of the fact that the solution to the many technical problems handled in the numerous other meetings and conferences would be evident from the actual official boundary documents, and it was therefore superfluous also to incorporate such technical decisions in special meeting protocols.

During the meeting on 27 September the Commission set up the program of work for all office work and adopted a proposal submitted by Soviets for the schedule, which specified time limits for the accomplishment of the various parts of the compilation work. According to this schedule, the geodetic diagrams, sketches, and photographs for each of the boundary protocols were to be ready for reproduction on 10 October, the maps on 21 October, and the final draft of the boundary marker protocols and descriptive protocols on 11 November. After proof-reading, possible corrections, and binding, the sealing and signing of each of the documents would take place from 20 to 25 November. By the adoption of this work plan an attempt was made to shorten work of compilation and publication to 2 months instead of the anticipated two and a half months (see Meeting Protocol No 6, II, which had

set the time limit from 1 September to 15 November for this work). In this manner, the Commission wanted now to try to make up for part of the delay which arose when the office work started almost one month later than planned. For this reason, several of the time limits set were very short and the small number of Norwegian experts had, therefore, an especially heavy burden of work from the beginning.

The instructions that special map sketches ("schematic sketches") and photographs of the boundary marker concerned be printed on the back side of each individual boundary marker protocol meant a great deal of preliminary redrawing, retouching, cutting out, mounting, name-setting, etc., work by methods with which the Norwegian experts were somewhat unaccustomed before the plates could be prepared. It also required considerable time to reproduce and print the 415 different back pages of the protocols.

The first serious delay occurred on 21 October when the Joint Commission, at the strong desire of the Soviets, resolved that on each of the drafts for the boundary marker protocols there be entered all the names for the map area in question which were mentioned in the written text of the boundary marker protocols (see Meeting Protocol No 29, I). This was an entirely new demand concerning the production of the sketches, and it meant additions and corrections in practically all of the 415 map sketches.

A modified method for drawing up the tables to be appended to the descriptive protocol (see Meeting Protocol No 29, II) was also adopted at the same meeting. These tables were actually to have been printed, but as a result of printing difficulties, they had to be typed. The tables are now printed as Sub-appendices I and 2 to Appendix 6 of this document, and one can see what a tremendous task these tables represent. In view of the modified method for setting up these tables, all of them had to be redone. Whereas they should have been completed by 22 October, they now were not ready until a month later.

The Norwegian Delegation in its meeting on 21 October found it necessary to call attention to the danger of serious delays in respect to the final completion of the work which the new proposal could cause. The committee therefore agreed to expedite the work of checking the completed documents by

appointing special expert "work committees" within the Commission, so that the whole Commission could limit itself to an actual discussion of the questions which could not be solved in the work committees. This proved to be a very fortunate arrangement in practice, since the committees which were set up worked swiftly and arrived at agreements easily on most of the questions.

The geodetic diagrams were ready in finished copy during October and on 10 November were finally approved for printing. The drafting of the boundary marker protocols was also finished in principle at the same time.

In spite of all efforts, by 15 November they were approximately one month behind schedule. According to the schedule of 27 September, the Delegation should have been able to be back in Norway before 1 December, which was already 10 days later than originally planned. Most of the members and experts of the Delegation had only a limited leave of absence from their regular positions, and they had now been away on Delegation business for more than half a year all told. The Norwegian Delegation found it necessary, therefore, in a meeting on 17 November, to give notice that it would set out for home on 10 December at the latest. After a rather long discussion, it was decided that the remaining work be rushed as strongly as it was justifiable (see Meeting Protocol No 30).

The main job that remained by 15 November was the rewriting of all the documents, checking of all maps before reproduction, editing of the description protocol, as well as the printing, proofing, binding, signing, and sealing of the documents.

By the resolution of 17 November, the Commission succeeded in speeding up the delivery of the many different forms which were to be printed so that the written work could begin in earnest. Inspection of the maps lasted until 18 November, and the individual map sheets were successively sent on for reproduction after the work committee had seen that all the work corresponded exactly to the adopted instructions. On 1 December, all of the maps were delivered to the printer.

The great delaying factor was the descriptive protocol. According to the work plan, this was to have been completely edited by the end of

October, but it was one month later before a final draft was submitted for discussion to the Joint Commission. In the last meeting of the Joint Commission at the boundary (see Meeting Protocol No 27) and express reservation had been made that "a number of minor editorial corrections" should be made in the boundary marker protocols and the descriptive protocol drawn up by the Subcommissions. As it turned out, during the work of compilation some major editorial changes were proposed. So as not to give up hope of concluding the work in 1947 at all, the Commission decided that the text of the boundary description should be taken as much as possible from the text of the boundary marker protocols, supplemented by data from maps and tables. This was also considered the most satisfactory editorial principle, since the boundary marker protocol, aside from giving a very detailed description of the boundary's course from marker to marker, also had been the subject of a month's careful examination in a special work committee.

The final linguistic collation of these many different texts which were to agree minutely with each other and also to be "of the same tenor," as it were, in two languages constructed so differently as Norwegian and Russian proved to be a particularly detailed and time-consuming project. This task was especially important in the relationship between the descriptive protocol and the boundary marker protocol.

In spite of the speedup, no documents proved to be ready for signing on 10 December, the date which the Norwegian Delegation had planned on as their day of departure. On the other hand, all the final work was so far advanced that they could feel quite safe in planning on being finished in the course of one week at the most. Under these circumstances the Delegation found it unjustifiable to discontinue the work. The work went on, therefore, and was finished in this order: Geodetic diagrams and sketches on 12 December, the tables on 13 December, the boundary marker protocols on 15 December, and finally the descriptive protocol on 18 December at 3 PM. The same afternoon at 6:30 PM the official signing and final settlement took place in the presence of representatives from the Norwegian Embassy in Moscow and from the Soviet Foreign Ministry.

A "conclusion protocol" is attached to the actual boundary documents and gives a short resume of the work. It states in conclusion that "all the work connected with the marking of the international boundary between Norway and the Soviet Union has been carried out in complete mutual understanding and that agreement has been reached on all questions concerning the marking of the boundary."

In order to supervise the necessary formal concluding work (binding and sealing of the protocols, etc.), Director Gladitsch and Bureau Chief Nygaard had to remain in Moscow until 10 January 1948; the others were able to set out for home on 19 December 1947.

During his final sojourn, Bureau Chief Nygaard also had occasion for a preliminary discussion with the chairman of the Soviet Delegation on the question of the two drafts for separate agreements, which in accordance with the Joint Commission's Regulations Article I, point 7, were to be worked out with regard to the administration of the boundary and the method of handling possible boundary conflicts and incidents (cf. also above, Section 9). Since with a view to the technicalities of marking boundaries, both delegations were necessarily large and unwieldy, and it was agreed that the work on the above-mentioned agreements should be turned over to the Foreign Ministries of Norway and the Soviet as separate matters.

With the exchange of the bound and sealed documentary portfolios (18 volumes in all) the Joint Commission considered its work finished.

12. The Norwegian-Soviet Boundary Demarcation Documents of 1947

The original boundary documents which the Joint Commission has completed and signed are included in the following volume:

I.

1. "Descriptive Protocol of the International Boundary Course between Norway and the Union of Soviet Socialist Republics (USSR), marked in 1947."

The volume contains the following:
Descriptive protocol (110 pages).

Table on the coordinates and heights for boundary markers and points in the geodetic net for the international boundary between Norway and the Soviet Union, marked in 1947 (37 pages).

Drawings of the boundary markers set up on the boundary between Norway and the Soviet Union, marked in 1947 (15 pages).

Including the title page, the volume contains 163 pages, taped and sealed.

2. The above-mentioned documents in Russian text (190 pages).

II.

3. "Album Containing Maps and Geodetic Diagrams of the International Boundary between Norway and the Union of Soviet Socialist Republics (USSR), marked in 1947."

The album contains the following documents:

Master map, to the scale of 1:200,000 (1 page), showing the placement of the map sheets. (The master map is photographed and printed as Appendix 7 to this work). Map of the international boundary to the scale of 1:25,000 (18 pages). (Three of the maps sheets - Nos 1, 11, and 18 - are photographed and printed as Appendix 8a, b, and c to this work. Sketches of the boundary markers and trigonometric signals (4 pages). (Several of the sketches are photographed and printed as Appendix 11a and b to this work).

III.

"Protocols of the Boundary Markers on the International Boundary between Norway and the Union of Soviet Socialist Republics (USSR), marked in 1947." (Three of the boundary marker protocols - one for land areas, No 191; one for water areas, No 250; and the buoy stake with a pair of alignment markers, No 415 - are photographed and printed as Appendix 10a, b, and c, to this work.)

4. Volume I, boundary markers Nos 1-172 (the Soviet work sector). With title page, the volume contains 173 pages, taped and sealed.

5. Above-mentioned documents in Russian text (173 pages).
6. Volume II, boundary markers Nos 173-415 (the Norwegian work sector.)
With title page, the volume contains 216 pages, taped and sealed.
7. Above-mentioned documents in Russian text (246 pages).

IV.

8. "Protocols of the Meetings of the Joint Soviet-Norwegian Commission for Marking the International Boundary between the Soviet Union and Norway." The volume contains 30 meeting protocols with enclosures, as well as a concluding protocol.

With title page, the volume contains 126 pages, taped and sealed.

9. The above-mentioned documents in Russian text (104 pages).

Each of the above-mentioned documents comes in two original double sets, one set for each party, 18 volumes in all, bound in leather. All the reproduction and binding work has been done in Moscow by the Soviet Union. All five delegates from each side have signed each individual document, and on each is placed the stamp of both delegations. Each descriptive protocol volume with appendices contains 32 such signatures and eight stamps; each map album 362 signatures and 74 stamps, and each set of boundary marker protocols, 4,172 signatures and 836 stamps. Each volume of documents is finished in four original signed and stamped copies (one copy in each language for each party), except the map album, which has text in each language and is therefore finished only in original copy for each party. Combined, these original copies have 17,540 signatures; 3,528 stamps; and 36 wax seals.

The following remarks should be made concerning the individual volumes:

The Descriptive Protocol

The descriptive protocol and the tables which belong to it are printed as Appendix 6 to this work.

The descriptive protocol has first a general introduction on how the boundary marking was conducted. Thereafter follows the actual boundary description,

in which it has been found convenient to divide the boundary district into five areas according to their respective topographical peculiarities. Before the description of each of these natural areas there is a short description of the area, and thereafter follows the detailed description of the course of the boundary from marker to marker, with exact indications of each boundary marker's position, and the length of the boundary from marker to marker. This detailed description from one boundary marker to the next is, for the most part, taken from the text of the boundary marker protocol and conforms to it completely. The northern terminus of the boundary marked in 1947 is numbered 415, and lies just north of the mouth of the Grense Jakobselv River. This boundary point is established as the point of intersection between two pairs of closely defined alignment markers. In view of boat traffic, a buoy stake also belongs to Boundary Marker No 415. Its mooring must lie at the point of intersection. Geographic as well as rectangular coordinates have been determined for Boundary Point 415.

Appendices 1 and 2 to the descriptive protocol are a table of coordinates and a drawing of the boundary markers indicating distances. The purpose of these tables is to give a short resume of the calculations which have led to the geodetic data pertaining to the boundary marking; that is, coordinates for the boundary markers and directional angles and distances between the posts. These tables are repeated in various combinations in the remaining boundary documents. The tables are introduced with some general explanatory remarks on the basis for the geodetic surveying which is done.

The Map Album

The Map Sheets Nos 1-9 and the Geodetic Diagrams Nos 1-9 which comprise the Soviet work sector (Krokfjell Mountain - Fløytaernes) are made by the Soviet group. On these sheets, therefore, the Soviet texts and signatures are placed in front of the Norwegian. The Map Sheets Nos 10-18 and the Geodetic Diagrams Nos 10-18, which comprise the Norwegian work sector (Fløytaernes - Grense Jakobselv's mouth) are done by the Norwegian Party. On these maps, therefore, the Norwegian texts and signatures are placed before the Soviet. Each party has carried out its topographic and geodetic

work according to the principles prescribed by the instructions and methods of its own country. Since these rules do not absolutely agree, the conventional signs, letter sizes, and other aids were necessarily somewhat different on Sheets Nos 1-9 and Nos 10-18. Corresponding sign explanations are therefore found on each individual map sheet. The four pages of sketches of the boundary markers and trigonometric signals have been prepared by the Soviets. The experts of the two delegations carefully inspected each others' work before it was finally approved for signature by the Joint Commission.

The Boundary Marker Protocols

A separate protocol has been set up for each boundary marker, that is, 415 protocols in each language: for certain of the protocols (for example, Nos 196 and 302) there are separate sub-appendices. Each boundary marker protocol has on the front side a printed form - there are different forms for the land area and the water area - with the special text filled in by typewriter. On the back page of each protocol there is a reproduction of a sketch and photograph of the boundary marker concerned, that is, a different plate for each boundary marker. These protocols indicate in detail the position of every single boundary marker in the terrain and its relation to the boundary line, by the usual description as well as by directional angles, coordinates, and distances.

Between the boundary protocols which have the Norwegian text and those which have the Russian text, moreover, there are the following differences which must be noted when the two texts are compared.

Since Norway used the newer 400 degree centesimal division of the circle, and the Soviet Union continues to use the older 360 degrees sexagenary scale, the angle indications in each protocol with Norwegian text are indicated in the 400 degree system with the corresponding number according to the 360 degree system added in parentheses. In those protocols with Russian texts, the opposite is the case.

On the forms for the water area which are printed with Norwegian text, the description of the Norwegian boundary post is placed first and thereafter the description of the Soviet post. On those forms which have a Russian text the series is reversed. On the forms for the land area this difference does not arise since the placement of both posts could be described under one heading.

All photographs of the boundary markers were supposed to have been taken in the direction of the next boundary marker. Because of difficult terrain conditions, it was not possible to carry this through everywhere, and in a number of cases (especially along the Jakobselv River) it was, therefore, necessary to photograph the boundary markers from another angle. The instructions for a scale of 1:50 for photographs and 1:5,000 for sketches could not be consistently carried out in actual practice either.

The Meeting Protocols:

The Norwegian Delegation's negotiation credentials of 27 July 1946 are bound into the front part of that volume of meeting protocols in Norwegian text which is in possession of the Norwegian government. Correspondingly, the Soviet Delegation's credentials are bound in the front of that volume of meeting protocols in the Russian text which the Soviets retained. All four of the meeting protocols, therefore, have a different number of pages.

A number of sketches and diagrams which illustrated how the boundary marking and other work was to be carried out originally belonged with Meeting Protocols Nos 5 and 20. These attachments were essentially loose sketches and drafts which have lost their significance, since the official map album contains exact work drawings, etc., of the different marker types. Since the sketches in addition were made out in various sizes different from that of the meeting protocols, they did not fit in well for binding together with them. The Commission therefore agreed that only those appendices to the meeting protocols which were not included in other boundary documents (i.e., The Regulations for the Joint Commission and the instructions adopted by the Commission) should be included in the meeting protocols to which they were

attached, and that the remaining appendices should be omitted.

With regard to the relationship between the different groups of boundary documents, the geodetic and topographic work has formed the core of the boundary demarcation. The result of this work, as concerns the boundary markers themselves, is found all through the tables (the attachments to the descriptive protocol), and these data have been recorded with a precision of 0.2 millimeters (in the scale of 1:25,000) on the prepared boundary maps, which, in addition, reproduce the topography of the boundary region with almost equal precision. A staff of experts from both countries have worked together for more than half a year on these maps and geodetic data. All the remaining documents are, both in the Subcommissions and in the subsequent office work in Moscow, prepared on the basis of the maps and the geodetic data. The descriptive protocol is therefore only a brief commentary in words which can be read from the maps quite independently. Aside from the general introductory and concluding sections, the descriptive protocol contains no information on the course of the boundary which does not also appear on the maps, while on the contrary, the maps - because they are a detailed graphic representation of the actual terrain - give a great deal of information which cannot appear in a brief boundary description.

The relationship between the descriptive protocol and the boundary marker protocols, the same obtains as regards the matter of the position of the individual boundary markers: For each of the 415 boundary markers a separate protocol has been prepared which repeats the same precisely calculated geodetic data (coordinates, directional lines, and distances) as the tables, and with a separate photograph of the boundary marker and a detailed sketch of its placement printed on the back page of the protocol concerned. Such a special document will naturally be able to give more information than the general summarizing descriptive protocol. In order to prevent misunderstanding, particular note is made in the concluding protocol, for the sake of safety, that "those sketches printed on the back page of the boundary marker protocols are concerned solely with showing the relationship of the boundary

markers to the characteristic terrain details." For all other map questions, naturally the official boundary maps (map album) are the only conclusive documents, since only these maps are drawn with adequate precision.

But even though each individual document has its own independent value as a coordinating document, naturally the whole complex group of boundary documents fit closely together and each must be seen in the light of the other.

It is on the basis of the above considerations that the conclusion protocol and the two sections preceding the last one in the descriptive protocol are formulated.

Each of the boundary marking documents is edited both in Norwegian and Russian, and it is expressly stated that both texts have the same validity. For this reason, it was necessary for the Commission to find expressions and translations which could be assumed to be as adequate as possible in both languages, even though to a certain degree this might be done at the cost of word choice and style.

In addition to the original signed and stamped copies of the boundary documents, 18 copies of all documents which were printed in the language of the country concerned, i.e., diagrams, maps, sketches, and boundary marker protocols, were presented to each party for distribution to the boundary authorities and other interested people in the homeland.

The following boundary marking documents were chosen by the Commission for submission to the governments of the respective countries for approval: the boundary description protocol with 2 tables attached, the 18 geodetic diagrams and the 18 map sheets of the international boundary, together with the 15 boundary marker protocols with their appendices. The documents will presumably go into effect immediately after they are approved by the governments. In this connection, the Norwegian Delegation proposed that the documents be made the object of a formal ratification. The Soviet Delegation then pointed out that the USSR did not usually exchange ratification documents concerning matters of this type. Their method of procedure was that the boundary documents be submitted to the governments for "approval," and go into force immediately after they were approved.

In a boundary affair like this one, this can also be a natural method of procedure. In the present case, no new boundary between Norway and its eastern neighbor is being proposed, but only a confirmation of the existing old boundary. The circumstances were quite different in 1826, when this boundary was established for the first time by a formal boundary convention which determined where the boundary should be drawn and which, in addition, contained a series of rules on rights and duties for both parties in connection with the boundary establishment. The Norwegian-Finnish boundary agreement of 1924 contained regulations similar to those of Agreement of 1826 and was eventually also ratified. The Norwegian-Soviet boundary documents of 1947 are, on the other hand, only corroborating marking documents. The Norwegian Delegation, therefore, found that it could accept the method of procedure for approval which the Soviet Delegation had proposed, since it was agreed at the same time that the approval from the Governments of the two countries was to be confirmed officially through a diplomatic exchange of notes. This is recorded in the concluding protocol.

In conclusion, the Commission proposes in the concluding protocol that "all work on the marking of the international boundary between Norway and the Soviet Union has been accomplished in full mutual understanding and that agreement has been reached on all questions on the marking of the boundary."

13. The Boundary Delegation's Budget

The Ministry of Foreign Affairs submitted in May 1947 a proposal to the Storting on the granting of the necessary funds for the execution of the boundary survey and the subsequent work in Moscow. The Department's calculations of the estimated expenditures were set up on the basis of an estimate submitted by the Boundary Delegation's planning director in Finnmark, as regarded the technical marking work, and from the Norwegian Geographic Survey as regarded the technical surveying work.

The Ministry of Foreign Affairs worked out in conjunction with this estimate of the amount which should be appropriated for the procurement and

and transportation of the necessary material, as well as for salaries, travel expenses, and subsistence for the delegation members and the technical experts.

The Department proposed a total amount of 743,000 kroner, of which 265,000 kroner would go for the work of demarcation, 105,000 kroner for the technical surveying work, 100,000 kroner for the procurement of materials, etc., 143,000 for salaries, travel expenses, and subsistence for the delegation's members, and 30,000 for the reimbursement of civil servants who were serving the Boundary Delegation, as well as 100,000 kroner for the subsequent work in Moscow.

The Foreign Ministry's estimate was approved by Royal resolution on 30 May 1947 and the bill on this was submitted as Storting Proposal No 1, Supplement No 26 (1947) "on a supplement to the national budget for the fiscal year 1947-48 under Chapter 112, Other Foreign Objectives."

The proposal was approved unanimously by the Storting on 3 July 1947.

The boundary delegation's stay in Moscow was, as mentioned before, of considerably longer duration than originally anticipated. That item in the budget (Chapter 112, entry 13 f), therefore, unavoidably ran in excess of the calculated amount. The Delegation had succeeded, however, in saving on other entries a sum which would supplement a part of this excess.

After the boundary survey, the reproduction and binding of all boundary documents was done in Moscow. With regard to the resolutions of the Joint Commission, the cost of this work was to be divided between the two parties.

In the above-mentioned supplementary proposal, Section II5, i.f., it is stated that at the time it was not possible to submit any positive information on the size of these costs, and that it was very possible that an additional grant would be necessary.

Norway's share in the reproduction costs amounted to 76,075.52 rubles, corresponding to 47,166.82 Norwegian kroner. This amount in its entirety had to be entered as an excess on the boundary delegation's budget.

Translation! According to the confirmed National Archives copy of a contemporary signed translation; place names are, however, corrected to correspond with the French original text.

APPENDIX 3

PROTOCOL

CONCERNING THE MAP OF THE BOUNDARY LINE BETWEEN NORWEGIAN FINNMARK AND RUSSIAN LAPPLAND

In consequence of the Agreement signed 2-14 May 1826 in St. Petersburg between His Majesty, the King of Sweden and Norway, and His Majesty, the Emperor of Russia, the two high contracting powers have appointed commissioners to collaborate in staking off the boundary line in agreement with the Fourth Article of the Agreement, inasmuch as provision for the same is in the Second Article, and to set up posts and other markers to indicate this line.

The commissioners appointed from each of the sides were:
., who met at Vadsø in East Finnmark on 22 June to 4 July 1826. After they had exchanged their credentials, which were found to be in proper order, they proceeded to their destination in compliance with the above-mentioned Agreement. They began their work at a place known as Kolmisoive-Madakjetza, a small mountain denuded of woods.

A stone cairn was built here which measured ten feet in diameter at the bottom and six feet in height. In the center of this cairn a carved stone was erected, on one side of which was placed the king's monogram, the date, and the number; and on the other side the Emperor's monogram, the date, and the same number. This boundary cairn bears the name Kolmisoive-Madakjetza Cairn and its number is 349.

Large stones were placed in the direction of the boundary line on both sides of this cairn, as well as at all the others which have been placed on the new boundary. They are at a distance of 30 ells or approximately

27 arshins, in order to indicate in which direction the nearest cairn or boundary marker may be found.

From Kolmisoiva-Madakjetza the line turns to the southwest down the slope of the mountain,

The distance between Boundary Cairns Nos 352 and 353 is 34,350 ells or 30,343 arshins.

The line now continues in a southeasterly direction as it goes down the slope of the Reisa-Gora Mountain, at the foot of which are found large swamps as well as large stretches covered with moss which it crosses. It then strikes a mountain range called Reisa-Dive, different parts of which are called different names, after which the line goes over the mountain peaks of Jukanjaurevara, Tsjaarnevara, Reiavara, and Tejadervara, which lie south of Kanegas-Jaure. From this last height the line passes the Niamechelage Mountain, where a forest was cut, and then to Mudkevara, quite near the little Avedem-Jaure Lake. From this point, where it was again necessary to cut through the forest, the line turns more toward the east, crosses swamps, and climbs up the Reia-Varatch Mountain. Here Boundary Cairn No 354 was erected. The distance between Cairns Nos 353 and 354 is 46,500 ells or 41,117 arshins. From this point, the line goes in a northeasterly direction, cuts across the Pasvig River south of Niachtz Falls, and touches the little mountain Reia-Niarg, which lies on the east bank of the Pasvig River at the confluence of the Gelsomio and Pasvig Rivers. Boundary Cairn No 355 has been erected on this mountain. The distance between Cairns Nos 354 and 355 is 2,700 ells or 2,387 arshins. On leaving this point, the boundary line follows the river to the north and crosses the middle of the Gelsomio or Niachtz Lake as far as Purn Falls, where Purn-Jaure begins. Here the line crosses a small island near the falls and then crosses over the center of Purn-Jaure. The line then goes over Boltze-Jaure where it also touches an island and continues to go along the middle of the Jaure Lake as far as Jorde-Fossen Falls. Thereupon it goes over Vegetem-Jaure and by following its thalweg passes to the west of the island Soivi Souala and three smaller islands. Upon nearing the Vuavasch Fossen Falls it touches an islet of the same name. From there it follows the western branch of the river where it is deepest; and after having passed Souana Fossen Falls

it goes through the middle of Kadelobel-Jaure, touches Karp-Souala Island with Niavde-Souala on its right, and then goes between the Leskot and Ogovo Islands in Poige-Jaure. It then continues to follow the river. After having passed Riamalla Fossen Falls to the left of Solovarek Island, it touches Vade-Souala where the Kjolme-Jaure begins, and passes across the middle of the lake until it meets Souala-Kouschk Island. It then crosses Vahl-Jaure (Kitovoe), passes to the left of Malas Souala Island and to the right of Kveschlot Island, goes past Niametzask Fossen Falls and continues to follow the river as far as Kavniss Mountain near the waterfall of the same name, where Cairn No 356 has been erected one verst south of Saints Boris and Gleb Church. Four cairns are built around this church, namely Nos 356, 357, 358, and 359. The distance between Nos 356 and 359, both lying on the west bank of the river, is two versts (3,396 ells) and the distance between Nos 356 and 357 is one verst (1,698 ells), as is the distance between Cairns Nos 358 and 359. The three cairns numbered 357, 358, and 359 are called Boris' and Gleb's cairns.

Near Cairn No 359 the boundary line crosses the Pasvig Elven River and extends in a southeasterly direction to a mountain upon which Cairn No 360 is built, quite close to Neid-Jaure. The distance between Nos 359 and 360 is 2,000 ells (1,768 arshins).

From this last cairn the boundary line goes in a southeasterly direction and cuts across Neid-Jaure, runs from there through a forest through which a vista for marking the line has been cut, and from there it strikes the Storgol-Oive Mountain where a stone boundary marker has been built in the form of a pillar. From this marker the direction is southeasterly and the extended line, which goes over mountains and through forests, is marked out with small cairns, like that on Storgol-Oive. Such small cairns have been built on the North Vaachtz-Oive and South Vaachtz-Oive Mountains. Since the terrain is very rugged and covered with forests, there was no possibility of building boundary cairns except south of Benags-Jaure, from which the Lax Elven River flows out, running eventually into the Jarfjord. This cairn has been placed on a rock quite near the Jaure Lake and is called Benags-Jaure Cairn, No 361.

The distance between Cairns Nos 360 and 361 is 34,250 ells (31,253 arshins). It was found necessary to clear away a great deal of the forest between these two cairns in order to indicate the line definitely. On leaving Cairn No 361, the line passes first two branches of the Benags-Jaure, and still running in an easterly direction goes through woods which were cleared in a width of 6 ells (5 arshins). These measurements were observed at every place where there was forest to cut. Later the boundary hits upon a mountain marked by a small cairn, thereafter passing over some swamps and through woods, and finally coming to the Voriegas-Oive Mountain, which was likewise marked by a small cairn. From there, the line passes over small mountains, then through woods, and again striking a hill marked in the same manner as Voriegas-Oive. Thereafter, it again goes through woods before it reaches the point where the three streams forming the Jacobs Elven River (Voriema) join. Boundary Cairn No 362 has been erected here on the western bank of the confluence of these streams. The distance between Cairns Nos 361 and 362 is 13,200 ells (11,664 arshins). The boundary then follows the Jacobs Elven River (Voriema) as far as its outlet in the Arctic Ocean near, Jacobs Vig Bay. The last boundary cairn, No 363, has been set up here on the east side of Jacobs-Vig Bay on a mountain quite near the outlet of the Jacobs Elven River (Voriema) in the Arctic Ocean. The width of the Jacobs Elven River at its outlet sic is insignificant, but it increases more and more along its course so that its bed at the outlet is almost 150 ells (130 arshins). The course of the Jacobs Elven River (Voriema) is northeast at its beginning, later running north. The distance between Boundary Cairns Nos 362 and 363 is 58,500 ells or 51,675 arshins.

Archangel, 16-28 August, Anno Domini One Thousand Eight Hundred Twenty-six.

(Signed:)

Lieutenant Colonel F. Mejlaender,
Commissioner for His Majesty,
the King of Sweden and Norway.

(Signed:)

Lieutenant Colonel Galamine,
Commissioner for His Majesty,
the Emperor of Russia.

Translation: The original document
is rendered only in French.

APPENDIX 4

PROTOCOL

CONCERNING THE BOUNDARY INSPECTION AND REPLACEMENT OF BOUNDARY MARKERS BETWEEN THE AMT OF FINMARK OF THE KINGDOM OF NORWAY AND THE PROVINCE OF ARCHANGEL OF THE RUSSIAN EMPIRE

Since their majesties, the king of Norway and Sweden and the emperor of Russia agree, in connection with the declaration of 20 May -- 1 June 1847, to have made an inspection of the line of demarcation drawn in 1826 between the Norwegian amt of Finnmark and the Russian province of Archangel, the two high courts have appointed commissioners to inspect said line, and if necessary to replace the boundary markers or to set up new ones.

The commissioners appointed for this project by the respective parties, namely,, met in Vadsø from 6 to 18 June 1896. After exchanging their credentials, which were found to be in proper order, and informing each other of the instructions prepared for the commissioners of the respective Ministries, they agreed to proceed to Jakobsvig (Worlema) the following day to begin the work.

The boundary line established in connection with the Agreement of 2-14 May 1826 had been inspected in 1846 and 1871 and the commissioners from these latter two years have pointed out the very serious errors, both in directions and in distances, on the map which is attached to the Agreement of 1826. In order to establish more precisely the boundary's geographic position, the commissioners were instructed to measure, partly with instruments, the whole strip which adjoins said line in the width of 1 verst, and to draw up a detailed map of the terrain surrounding each national cairn. The scale was set at 1:42,000 for the surveying and 1:8,400 for the detailed map.

On 8-20 June the commissioners proceeded to International Cairn No 363 (Jakobsvig or Worlema) which was found to be in good condition and needed

no repairs since it was built very solidly of large stones and cement. The heart stone at the top of the international cairn bore on the side facing Norwegian territory the inscription: monogram and crown of His Majesty King O XIV/1826/N363/Rest 1846/do. 1851/; and on the side which faced the Russian territory: monogram and crown of His Majesty Emperor N I/1826/N363/Rest 1846/do. 1851. The cairn stands on a small crag east of the Jakobselv River (Worlema) between its outlet and a small bay (Russekilen) and is on Russian territory outside the boundary. To avoid the misunderstandings which could be created by this placement and to establish more accurately the position of the boundary line, the Commissioners agreed to a proposal by the Russian commissioners that a secondary and supplementary marker be set up on the Norwegian side of the river. For this purpose, they chose an almost perpendicular mountain side which served as the foundation for King Oscar II's chapel, and in this they cut a circle, the center of which represents the marker; under this circle they carved the year 1896 and the words "boundary marker" in the two languages, Norwegian and Russian. Beside this, also in the two languages, they carved the inscription: "From here to the boundary line in the river, 530 meters in a direct line toward International Cairn No 363." In the mountain in front of International Cairn No 363 they cut a similar inscription, likewise in the two languages, namely: "From the international cairn to the boundary line in the river, 75 meters in a direct line toward the boundary marker on the mountain on the Norwegian side."

(See the map of the terrain around the International Cairn No 363.)

It is necessary to note expressly that the erection of this marker in no way changes the provisions in the agreement of 1826.

From the point where the Jakobselv River (Worlema) flows into the Arctic Ocean as far as International Cairn No 362, the boundary follows the current of this river (the original text uses here and in the following the words "le courant"; by this is meant what is now called the "thalweg.") At its outlet, the river runs between low sand banks which are covered at

high tide by several feet of water and which form quite a good harbor for small fishing boats, protected from the sea by a large headland. (In the French text appears the word "clune," which is assumed to be a misprint for "cluse.") It is on the shores of this strand that the only habitations of the lower part of the valley are found; on the Norwegian side, the houses in Jakobsvig, and on the Russian side the houses in the Worlama colony. A fairly good road about 8 kilometers long leads from here to Heimdal, the last place of habitation in the upper part of the valley, and here the river is navigable for large boats. From here to its source, the river runs through a wide valley enclosed on both sides by naked crags. The river bed is rocky and the current quite swift, but at no place is there any indication of its having altered its course since 1826. The islets which the river forms are marked with an "N" on the Norwegian (western) side of the current thalweg and are marked with "R" on the Russian (eastern) side. The direction of the boundary is south-southeast as far as the Jakobselv Lake (Worlamajaur); here the valley swings toward the west and continues in this direction as far as International Cairn No 362.

Previous descriptions of the position of this international cairn state that it was placed near the source of the river formed by the confluence of three small streams. Actually, only two such streams can be found, of which the larger has a small tributary a little further up. (See the map of the terrain around International Cairn No 362).

The cairn, which was half fallen, was repaired, and the heart stone containing the names of the two monarchs, which was found near the cairn, was replaced.

Here the boundary changes direction; this change is marked by an indicator placed in a small cairn at a distance of 30 meters from the international cairn. Between International Cairns Nos 362 and 361, the general direction of the boundary is toward the west. It is marked here by four markers or intermediate cairns and by vistas in the woods through which it passes.

In 1826, it was decided that the vistas should have a width of 6 ells or 5 arshins (4 meters). The commissioners, who found this width much too inadequate, since the firebreaks were almost invisible at any distance, agreed to double it or increase it to 8 meters and to clear the line as well as possible of old fallen trees.

After passing through a small woods, the boundary strikes a little hill, where the first intermediate cairn is found. It then goes up over the Voriegas Oaive Mountain, on the northern slope of which the other cairn is placed. The third cairn is built on a hollock which the line reaches after crossing a large swamp, through quite large birch forests, and across a creek which flows into the Lake Bissodjavre. Between this hollock and Lake Baena Javre, the fourth cairn is found on a small hill. It consists of only a large granite block and is marked with the year 1896. All these cairns have been restored and the line corrected between them, and between the last one and International Cairn No 361.

This international cairn, which stands on a large stone in the middle of a little swamp by Lake Baena Javre, is very difficult to see. It is presumed that it is this circumstance which has been the reason for the errors in cutting vistas which can be seen in both directions. The new vistas have exactly followed the track established in 1826.

The international cairn, ~~was found to be in~~ good condition, as were the indicator stones east and north of the international cairn.

From International Cairn No 361 the boundary takes a northwesterly course as far as the succeeding International Cairn No 360 near the Pasvig or Pazrek River; on this stretch are found four more intermediate cairns, between which the boundary proceeds in a straight line. The line between International Cairn No 361 and the first intermediate cairn, the one on South Aborvasfjeld (Syd Vaachts Oaive), is not exactly straight. At its lower part, near Lake Baena Javre, it curves a little to the east, but since this bend does not form any significant angle, it has not been possible to find an appropriate

place to mark it by erecting a cairn, and the old vista has also been followed here. The second intermediate cairn is found on the mountain North Abervassfjeld (Nord Vaachtsoaive), the third on the mountain Stuorgolcaive, and the fourth on the mountain between the two lakes Langvand (Gukkioluobal) and Pigevand (Neid Javre). The intermediate cairns and the International Cairn No 360 needed only small repairs. The terrain between the International Cairns No 361 and 360 is very rugged, and the intermediate cairns mark the prominent points. Staking out the boundary and clearing the woods in the deep valleys was very difficult and laborious.

A trigonometric signal, built by the Norwegian topographers and similar to the intermediate cairns, is to be seen 126 meters south of the Stuorgolcaive intermediate cairn.

At International Cairn No 360, Neid Javre, the boundary swings toward the southwest, heads down over the right bank of the Pasvik (Pazrek) River, goes up the opposite bank, and follows the parallelogram the corner of which is marked by International Cairns Nos 359, 358, 357, and 356, and which surrounds the Russian Boris and Gleb church, and the Lapp village of Pazrek. The international cairns were found to be in good condition, but their placement did not correspond absolutely to the description given in the Protocol of 1826, in that the distance between the Boris and Gleb church and the International Cairns No 356 and 359 is not 1 verst as stated in the protocol, but almost 1.25 versts (1.3 kilometers), just as the distances between the International Cairns Nos 356 and 357 and between Nos 358 and 359 are not one verst but actually about 1.5 and 1.1 verst respectively (1.6 and 1.1 kilometers). Here, as everywhere else, the forests were cleared to the agreed new width. The Commissioners drew up a map showing all these international cairns and indicating the terrain conditions in the vicinity of each of them and their position. The terrain which the line follows is very rugged here; also, the international cairns are placed on quite high mountains separated by deep valleys and small lakes. From International Cairn No 356, the boundary

line goes without changing direction down the left (western) bank of the river to the middle of the Pasvik (Pazrek) River, a little south of Skoltefoss Falls or Pazrek-Cataract (Kevnis).

According to the treaty of 1826, the line of demarcation between International Cairns Nos 356 (Kevnisvarre) and 355 (Raja Njarg) should follow the current in the large Pasvig (Pazrek) River or the middle of the lakes it forms. Actually, the river is more like a row of large and small lakes between which the river runs in rapids or falls.

Since the instructions for the delegates of the two countries prescribed that they reestablish the boundary as provided in the Agreement of 1826, the Commissioners in 1896 were also obliged to follow the description given in the protocol going with the map of the line of demarcation between Norwegian Finnmark and Russian Lappland, dated Archangel, 18-28 August 1826, attached to said convention. Since this map gives only a much too general and inaccurate idea of the river and its lakes, the description is also stamped by this defect. There are also some places where the general principle of the greatest water depth could not now be followed, as is shown above.

Concerning the use of names, it has been necessary to affix in the following, in addition to the names which are found today, the names from 1826 in parenthesis, wherever it is possible to identify them.

After leaving the left (west) bank of the Pasvig (Pazrek) River, the line of demarcation follows the thalweg in Fossevand Lake; this lake with its steep sides is constricted to small rapids in its center. At a distance of about 4 kilometers from International Cairn No 356, the mountains close in from both sides and block the valley where the river flows through Harefossen Falls (Niamelzask). From here, the line goes along the Klistervand Lake or Kitozero (Wahl Javre), which is much larger than the first little lake, and it then comes to Holmfossen Falls or the falls at Souala Kouschk. The general character of this lake is the same as farther down the Valley; small wooded mountains, which diminish in size in the southern part are seen here. Along the demarcation line on the east side (Russian side) is Storholmen Island

(Malos Suola), and then farther up are the little island of Elenholmen (Kueschlot) and the islet of Øggasholmen, both on the west side (Norwegian). At Holmefossen Falls or Souala Kouschk, the line crosses a small island which also bears the name Souala Kouschk.

Since the Norwegian and the Russian Governments have agreed to partition this island dividing the falls into two equal parts, the western belonging to Norway and the eastern to Russia, the Commissioners had to carry out this work in the field. In this regard, a detailed map was drawn up of the island, its area was calculated, and two points were established on the north-east and southwest shores between which trees were cut to form a vista 8 meters wide. On these established points, two cairns of rough stone with center stones bearing the year 1896 on both sides were erected on the shore.

After crossing the island of Souala Kouschk, the line of demarcation follows the northern branch, known by the name Bjørnevand (Kajen Javre), of the large Lake Coalbmejavre or Tschalmezero (Kjolme Javre), and the lake itself. The lake extends for 18 kilometers between banks which are low and swampy, but covered by fir trees, first in a southerly direction, but little by little turning toward the west. On first approaching the river's main branch, one passes an island, "Lille Skogøen," (Vade Suola) which at low water level is connected with the mainland by a sand bank. This island belongs to Norway.

The Pasvig (Pazrek) River divides at Coalbmejavre into two branches, of which the larger enters the lake at Lille Skogøen" and the other 1.5 kilometers farther south. The island formed by these two branches, bears various names: "Mannikko Suola," Saari Warakka (Solovarek, Store Skogøen); it belongs to Russia.

From the outlet at "Lille Skogøen," the boundary follows the river in a west-northwesterly direction for the first 3 kilometers, then swings toward the southwest, where it meets the Melkefossen Falls (Cataracte Majadac) Rapids after 4 kilometers, and 5 kilometers further up, the large falls "Mannikko" (Cataracte Riamalla), the highest falls in the whole river.

The lower part of the valley here is of the same nature as Coalbmejavre, with its swampy banks, but above Melkefoss Falls, the mountains approach

each other and the surface of the ground, strewn with large stones, clearly bears marks of the glacial period.

From Männikko the line goes into Lake Boasojavre (Peige Jaure), which is 10 kilometers long, and it follows this in a southwesterly direction to the "Kobbefos" Rapids (Cataracte Louest). In the southern part of the lake there are two islands, one of which is on the Norwegian side (north) and the other of which is on the Russian side (south).

After passing Kobbefos Rapids, the line follows the lake "Gaddaluobad" (Kadelobel) almost due west for 5 kilometers; in the lake there are two islands connected by a bar. These islands belong to Norway since the thalweg runs south of them. The islands which are shown on the map of 1826, have not been located.

The course of the river between Gaddaluobad and the large Lake "Vaggetom Javre" is a narrows in which one first encounters the "Gaddaluobalguoikka" Rapids (Cataract Souana) and a little further up the "Vaggetesguvikka" Rapids (Cataracte Vuovasch). The river here has two branches which go around a small island 1.5 kilometers long and 200 meters wide.

In accordance with the protocol of 16-28 August 1826, the boundary here is supposed to follow "the western branch of the river, which is the deepest." Upon investigating this place, the commissioners found that the eastern branch or Vaggetesguvikka is very large and goes in rapids, and that the western branch is formed by three small lakes, fairly deep (2 to 3 meters), connected to each other and to the eastern branch by a stream which is smaller than the eastern branch. According to the commissioners, who found the earth there to be formed by large stones and containing no sand, and who observed fir trees and birches which could be estimated at a hundred years in age on the banks of the stream, the western stream could not have been very large even in 1826. It was also found that it was shallower than the eastern branch, and according to reports from the inhabitants, it becomes nearly dry at low water level.

Since, however, the boundary on the Norwegian map from 1825 and on the copies of the map from 1826 which are in the hands of the delegates

are marked in the same manner, that is, following the western branch, the commissioners of the two countries believed that they also had to have it to follow in the same direction in the future.

The Norwegian commissioners tacitly understand that even if the boundary there or anywhere else, in the future goes along an old dried-up course, and both banks thus belong to Russia, those rights in the river which are guaranteed Norwegian citizens through Article 9 in the Agreement of 1826 shall nevertheless be retained by them.

The Russian commissioners for their part, declared that they could not discuss these rights, since their credentials and their instructions did not permit them to discuss questions other than those immediately concerning the position of the boundary line.

In the large lake Vaggetem, the boundary turns to the southwest for the first 4 kilometers, but for the last 10 it turns to the south. The banks of the lake appear the same as farther down, a shore covered by large stones and fir forests. The highest mountains are quite far away on the Norwegian side, but on the Russian side, Galgoaive, the highest mountain in this area, raises its naked peak close by the water. In the southern part, sand banks appear for the first time, especially on the island of Caevassuolo (Soivi Suolo). The boundary line follows the middle of the lake, first meeting two islands in the west (Norway) and three in the east (Russia) and then going along the western bank of the Russian island of Caevassuolo (Soivi Suolo) and separates it from an islet, which falls to Norway. The thalweg is now east of the island, and the sound which separates it from the islet becomes dry at low water level, according to the Lapps. But since the bottom here is formed by sand, it is possible that the current has followed that course as marked in 1826.

At Caevassuolo Island the lake divides: the larger part pushes in two branches toward the west; the smaller part turns south to Jordeguoikka (Cataracte de Jorde) where a short stream separates it from Bacjavre (Boëtze Javre); the latter is 11 kilometers long, but its width does not exceed two kilometers and decreases for the most part to 0.5 kilometers. In the southern

part, it contains several small islands, some of which belong to Norway and the others to Russia. The exact position of these islands is marked on the attached map. It is apparently one of these islands which the description from 1826 mentions when it says that the line touches an island in Boetze Jaure. At the rapids at Haevoeguoikka one can see that the lakes end. There are a couple more; for example, there is a little lake below Dorneguoikka (Cataracte Purn and the Purn Lake) and Gelsomic (Njakoe) Lake, but on the whole one can travel the 14 kilometers which separate Haevoeguoikka Rapids from Raja Njarg on a river approximately 100 meters wide, which flows quite freely between sand banks from which the two shores extend out like wide plains covered by fir forests. Not until one approaches Raja Njarg does one come across a small chain of mountains which the river has cut through, forming the Rajaguoikka Falls. On the slope of this chain on the south side of the lake, International Cairn No 355, called Raja Njarg, stands at a distance of 1 kilometer west of the confluence of the Pasvig or Pazrek and its tributary, the Gelsomic.

The cairn was found to be in good condition, and the center stone in which is carved the names of the monarchs, the year 1826, and the number 355, was in place. (Below the center stone these words were found on both sides, in Norwegian and Russian. On one side was: "Rest af Tafteson 1851" and on the other side: "Rest 1851 Titoff").

That islet, which, according to the description of 1826, the line was supposed to pass at Raja Njarg, is actually only a naked rock several meters in length.

While the general direction of the Pasvig or Pazrek River from Lake Vaggetemjavre to Raja Njarg is southwest to south, it breaks there at almost a right angle to the northwest, in the direction of International Cairn No 354, Raja Varas, which stands only 2 kilometers from Cairn No 355. The boundary goes first down the slope to the river, crosses over the Rajaguoikka Falls, and an extension of the form of a round dam, and goes up to the crag where International Cairn No 354 is built. It was in good condition. The old vista was restored and widened to 8 meters. Along the 5 kilometers stretch which

separates this international cairn from the intermediate cairn, Mutkavaara, marking the terminal point of the Province of Archangel and the beginning of the Grand Duchy of Finland, one crosses over flat, swampy terrain at the foot of that ridge upon which the intermediate cairn is built. Since the direction of the old vista was not in a correct, straight line, the error was corrected and the forest cleared to the agreed width of 8 meters. The intermediate cairn at Mutkavaara was found in quite good condition and needed only a little repair. (See map of the terrain around the Mutkavaara cairn).

The boundary map is based on Norway's trigonometric net.

Appendix:

1. Map of the boundary (partly drawn up with instruments) between Norwegian Finnmark and the Russian Province of Archangel, to the scale of 1:42,000.
2. Map of the terrain around the international cairns from Nos 363 to 354, to the scale of 1:8,400.
3. Map of the island of Soula Kouschk and of the intermediate cairn Mutkavaara, in the scale of 1:8,400.

In confirmation hereof, the commissioners have had two copies of this protocol and one copy of the map made out for each party, all similar, signed by them, and provided with their seal.

Drawn up in Vadsø on 7 - 19 September in the year of Our Lord Eighteen

Hundred Ninety-six

The Commissioners of His Majesty
the King of Norway and Sweden:
(s.) Colonel W. Haffner

(seal)

(s.) Captain E. A. Eriksen

The Commissioners of His Majesty
the Emperor of Russia:
Colonel on the General Staff
(s.) Vladimir Markov

(seal)

Captain on the General Staff
(s.) Dimitri Replev

Military Topographer,

Honorary Counsel

(s.) Paul Lepine

Representative for the

Department of the Interior,

Honorary Counsel

(s.) Michail Prialoukine

50X1-HUM

CONFIDENTIAL

carbon copy 1/2
(for original requestor)

C I A

FOREIGN DOCUMENTS DIVISION

10 Oct 1951

50X1-HUM

Certain Defects in Mountain

River Basin, V. M. Fandorin

hidrotekhnika i melioratsiya, No 1, pages 63-69
Moscow, January 1951.

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

CERTAIN DEFECTS IN MOUNTAIN RIVER DAMSON CERTAIN PROBLEMS IN CONNECTION WITH DAMSON MOUNTAIN RIVERS

V. V. Fandeyev
 Candidate of Technical Sciences;
 (Moscow Irrigation Institute imeni
 V.R. Vil'yams)

To procure water for power and irrigation purposes, it has recently become a common practice to construct dams with built-in, grate-covered, water-intake troughs on mountain rivers.

In Georgia, Armenia, Kazakhstan and other Soviet Socialist Republics, many such dams are already in operation; dozens more have been designed and will be erected within the next few years. Dams with built-in, water-intake troughs have the advantage of minimally constraining the cross-section of a river; of securing water-intake at all possible water levels in the river; of allowing unimpeded passage of flood waters, floating bodies, and large bottom drifts; and of making possible a quick restoration of the dam in case of its becoming clogged with stones and silt (eroded by flood water from denuded soil). Knowledge of operational data for such dams is very thinly spread among hydrotechnicians; such knowledge is quite important for the elimination, in the construction process, of some errors and deficiencies, which occasionally occur in the designs. Faulty design, which results in the rapid clogging with sand and gravel of the water-intake troughs, insufficient intake capacity of grates and troughs, etc., constitutes an obstacle to the normal operation of such dams. Practical acquaintance with several such dams (in operation as well as in design) allows the writer to make a few remarks on the operation of various parts of such dams, on their failures, and on methods of eliminating these failures

- 1 -
CONFIDENTIAL

CONFIDENTIAL

1. ON CLOGGING OF THE WATER-INTAKE TROUGH

One of the constructions with a clogged trough is the dam on the Yegun-arkh River (Armenian SSR), erected in 1935-1937. The dam is located directly below a bend of the river (Figure 1). The width of the water-intake trough is 12 meters, the width of the river bed is 5-7 meters. As should have been expected the ~~curvature~~ of the bed caused alluvium to be deposited in front of the right part of the dam, thus forming an island covered with bushes and trees as much as 4 meters high. Consequently, the water flows mainly over the left side of the dam, that is, water intake occurs only along approximately one-half the width of the trough (the right side of the trough remaining practically out of operation). Correspondingly the maximum intake has been decreased by almost one-half (not exceeding 1 - 1.2 cubic meters per second).

A grate (of 8 millimeter thick flat iron with 42 millimeter interstices) horizontally covers the trough; the cross-section of the trough is rectangular with dimensions of 1 by 1 meter.

At the time of inspection of this dam (July 1949), the whole water discharge of the river, amounting to several dozens of liters per second, with a 2 - 3 centimeter layer of water over the grate, was routed via the trough. Grate interstices were clogged with gravel; some members of the grate were overgrown with moss. After lifting one section of the water-intake grate, the inspection

CONFIDENTIAL

CONFIDENTIAL

revealed (Figure 2) that the right side of the trough was choked up with sediments to approximately one third of its height; on the left side, however, where water was being taken in, sedimentation occurred to a lesser extent. The sediment in the trough mainly consisted of gravel under 40 millimeters in diameter; it contained only a small amount of sand.

The main reason why the trough becomes clogged with gravel and sand is attributable to pitch of its runoff (0.01) and in the slow flow of water in the trough when taking in low, flow is so slow that it does not sweep away the material which drifts into the trough. Ingress of gravel into the trough is due, in this case, to the large size of the grate interstices. It is undoubtedly unfortunate that the design called for location of the dam just below the curve in the river and for a water-intake section wider than the average width of the river bed; this accounts for the spreading out of the current, for the silting of the headwater, and for the ingress into the trough of a retarded current. Besides these deficiencies in the design of the dam, lack of systematic supervision of its operation must be mentioned, such as failure to take measures against deformations of the river bed above the construction, irregular cleaning of the grate and trough and so on.

A different instance of the way in which troughs function is shown by the dam on the Bol'shaya Almatinka River, where the water-intake trough (with 25 millimeter grate interstices) catches sand and gravel. According to B. Rastokuyev, the chief engineer

CONFIDENTIAL

CONFIDENTIAL

of the construction, it was not necessary to clean the trough a single time during the 5 years of its regular operation, because everything that drifted in was being automatically swept out. Drifting gravel is diverted before entering the trough by the gravel-catcher, which is located at the head of the canal approach; from there the gravel is swept down into the tailwater; drifting sand is deposited in a settler also situated in the canal approach. [Thus,] the water-intake receives [only] 70 - 80 percent of the total river discharges. The grade of the trough is 0.04. Its cross-section is semicircular in the lower part, which is 2 meters in diameter; the upper part is rectangular and is 2 meters wide (Figure 3). The combination of the rotary motion of the influshing water caused by the semicircular cross-section of the trough and the gradient of the trough's runoff [athwart the river], creates a spiral motion, which is favorable for the sweeping away of the [foreign] matter which drifts in. The current then flows out through the aperture in the separation buttress (separating the water-intake trough from the chamber of the right flushing sluice; Figure 4) with a turbulence, which indicates a considerable speed of the current. At the time of the inspection of the dam (early in August 1950), the ceiling of the aperture was exceeding the level of the current by about 0.5 meters. Thus, the velocity in the aperture (having dimensions of 2 by 1.7 meters), when, as at the time, the water-intake was 4 - 4.5 cubic meters per second, amounted to 1.7 - 1.9 cubic meters per second, which effected the sweeping away of the extraneous matter from the trough.

- 4 -
CONFIDENTIAL

CONFIDENTIAL

This case shows that, when speeds are maintained which are sufficient for conveying the foreign matter, the settling of such matter within a water-intake trough is avoided. However, the trough cannot be protected against the inflow of drifting sand, because it is not feasible to install grates with interstices narrow enough to prevent the infiltration of sand particles. Consequently, the special settler (sand-catcher) must be considered as the principal remedy for drift-sand. Everything which drifts into the water-intake trough must be swept out by the current.

The gauge of grate interstices must obviously be set in accordance not only with the size and quantity of foreign particles carried along by the river, but also with the amount of water which flows into the trough at any given time. In some cases the volume of the water inflow is insufficient to develop a velocity in the trough sufficient to sweep away large foreign particles even where there is a proper gradient in the runoff of the trough; in such instances it may be advisable to reduce the interstices of the grate in order to reduce the size of particles which slip through; otherwise, it is obviously necessary to regularly and systematically clean the trough. In this connection the speed of water in the trough during periods of lowest water intake must be considered.

2. ON INTAKE CAPACITY OF THE TROUGH

The shortcoming of the Dol'shaya Almaatinka River water-intake dam lies in the fact that the intake capacity of its trough is less than was initially contemplated.

CONFIDENTIAL

CONFIDENTIAL

For that reason, the operating personnel are forced to open the headgate of the winter aperture of the right flushing sluice in order to catch an additional discharge. (Figure 4). The trough takes in about 50 - 75 percent of the rated discharge; with average discharges of the river (8 - 10 cubic meters per second), the trough is completely filled with water and operates under pressure.

When the left span was closed with dam walling (early in August 1950), the current was flowing over the right span grate in a layer 0.4 - 0.5 meters thick. The bulk of the water intake was falling through the grate (2.1 meters long) on approximately one third to one half of its length measured from the headwater side. On the middle portion of the grate, the current was turbulent, while on the tailwater portion of the grate (when this portion was not covered by water), one could observe how the water was rising out of the trough and flowing away over the tailwater edge of the grate.

Insufficient water intakes, as against those anticipated may have two explanations. In the first place, the water intake is insufficient due to the fact that the semicircular lower profile of the trough (Figure 3) gives a rotary motion in the gallery to the flow of water in the trough, thus impeding the current's flow over the tailwater portion of the grate's length. The laboratory research of A. I. Arykova, carried out at the VNIIGME* under the direction of Professor Ye. A. Zamarin, shows that, in a trough having such a form of cross-section, the water moves in the following way (Figure 5): after having entered the

* [All-Union Scientific Research Institute of Hydrology and Soil Improvement.]

CONFIDENTIAL

CONFIDENTIAL

trough the headwater third or half of the grate's length, the current (especially, in case of the lowest and below average river discharges) moves along the headwater wall of the gallery, then bends upward along the tailwater wall; this not only prevents water from entering the trough on the tailwater fourth or third of the grate's length but it causes some of the water to flow back into the river. The actual behavior of the water flowing through the trough of the Bol'shaya Almatinka River dam closely resembles that observed in the laboratory.

Secondly, according to observations, level of the water flowing over the tailwater edge of the trough is higher at the upper cross-sections of the trough (in the left span) than at the middle portion of its length. At the lower cross-sections of the trough (near the separation buttress), water does not flow over the edge at all (Figure 4). Apparently, the water which enters the trough through the right span of the grate and fills up the trough's cross-section (the trough deepens from 1.30 meters at the left end 1.85 at the right end) is not drained away quickly enough due to the insufficient intake capacity of the trough; thus a counter-pressure develops in the upper cross-sections, which forces some water to flow back into the river. The veritableness of such an assumption is corroborated by the fact that when the trough works under pressure, water enters it in an uneven way; specific discharges are higher at the lower portions of the trough than at the upper ones. On the other hand, with the same amount of pressure over the grate, discharges are known to be smaller when the trough works under pressure than at times when there is no pressure over the trough (V. N. Fandeyev, "On Designing the Water-Intake Trough in Dams on Mountainous Rivers," *Gidrotekhnika i Melioratsiya*, No. 8, 1949. His article contains

CONFIDENTIAL

CONFIDENTIAL

~~Engineering and Reclamation, number 6, 1949; this article contains~~
 an error in formula (4) in which φ must be replaced by $\varphi - \theta$ (the
 discharge coefficient).

To reduce the rotary motion of the water flowing in the
 trough a form of trough cross-section, suggested by Professor
 Ye A. Zamarin, can be recommended (VASKHNIL Reports, issue 7, 1950).

This section is rectangular and is wider than the span of
 the grate, which is placed on cantilevers protruding from the trough
 walls. To facilitate the sweeping out of foreign matter, the
 trough bottom may be given a slant against the axis of the trough
 (Figure 6). The widened part of the cross-section are intended to
 impede the smooth current and to hinder the development of a rotary
 motion in cross-sections of the trough.

3. ON SEDIMENTATION IN THE TAILWATER

The channeling of a considerable part of the river discharge
 into the water-intake trough results in the deceleration to in-
 significant speeds of the residual current which
 flows over into the tailwater. Consequently the conveying capacity
 of the current decreases so sharply that it is not able to carry
 large ground drifts away from the dam. This leads to the formation of
 sedimentary deposits in the tailwater, and to the development of
 banks which gradually build up to the grate section of the dam.
 In 1948 a dam was erected on the Khidzorkut River near the village
 of Aygedzor (Armenian SSR); one year later a bank of stones and
 pebbles, which filled up the apron pit, could already be observed below

* [Academy of Agricultural Sciences
 Memoir 1950]

CONFIDENTIAL

CONFIDENTIAL

this dam. This bank presents an obstacle to the smooth flow of water away from the construction and directs the current along the dam thereby impeding the water intake of the trough.

According to the operating personnel of the Dol'shaya Almatinka River dam, with average river discharges and with a water intake of 60 - 70 percent of these discharges, about one thousand cubic meters of drifts per day were accumulating in the tailwater during July and the first half of August 1950. In the daytime, the river bed was being cleaned by a bulldozer; at night, when the hydroelectric power station was shut down, the accumulation was being flushed away by allowing the whole flow of the river to by-pass the water-intake. In previous years, the tailwater had been cleaned once every 3 - 5 days, depending on river discharges and on the amount of drifted matter (the recent increase in the amount of drifts ~~is accounted for~~ is accounted for by the fact that since the last flood, which eroded denuded soil, the river continues to wash away the matter which had been eroded by the flood and which had subsequently settled in the river bed and in the inundated valley). The more the water was drawn off by the intake and the less it flowed over into the tailwater, the more frequently the river bed below the dam had to be cleaned.

During the inspection of this dam, it could be observed that the current was carrying stones of 30 - 40 centimeters in diameter, which were rolling over the grate with a characteristic gritting. A bank of stones, immediately abutting upon the tailwater wall of the

- 9 -
CONFIDENTIAL

CONFIDENTIAL

dam was being built up along a section of the apron pit which was 1.5-2 meters wide. In that section, stones carried by the current were caught by the bank which was gradually growing towards the dam. From time to time some stones stuck in the grate and closed the interstices. A guard on duty who was watching from a footbridge, dragged and pushed these stones down from the grate by means of a bifurcate pitchfork and a shovel.

To increase the conveying capacity of the current, a concentrated discharge into the tailwater is desirable, but generally speaking this cannot always be achieved (especially when the percentage of water intake is high). It is advisable to try out, in laboratory conditions at first, the operation of dams with ground apertures (located below the bottom of the water-intake trough; Figure 7) which would discharge a steady current into the tailwater. Installation of such apertures is certainly expedient if the river discharges in summertime exceed the volume of the water-intake. Dimensions of the ground apertures must be large enough to allow passage of the stones usually carried by the current.

Operational data on several water-intake dams indicate that grates constructed of rods with circular cross-section give unsatisfactory service.¹

Grate, "Hydrotechnical Constructions, number 10-11, 1939 L. A. Gorbachev, Tyrolean Water Intake for Catastrophic Floods Drifting Eroded Matter from Denuded Soil." Hydrotechnical Constructions, number 12, 1947. The grate of the Sol'shaya Almaatinka River dam, built in the years

CONFIDENTIAL

CONFIDENTIAL

of the Great Fatherland War, was made of rods of 20 millimeters in diameter with 10 millimeter interstices. During the operation of the dam, this grate was continuously cleaned. Special workers were assigned for that purpose. By means of pickaxes, they plucked out the gravel stuck in the narrow parts of the interstices, and with shovels pushed it into the trough. Due to such a cleaning method, the rods were bent and were torn off at the welded seams. In 1949, the rods were partially replaced by narrow-gage rails (with 25 millimeter wide heads) from which the flanges had been cut off; the rails were set at intervals of 25 millimeters. Thus clogging of the interstices was reduced, because the gravel which stuck on the grate could then be pushed down more easily into the trough. Most of the gravel clogs up on the headwater portion of grate. The most favorable shape of rod is the trapezoidal form with the broader side on top (Figure 8). Such a profile requires a special rolling process; consequently, as already mentioned, narrow-gage rails with the flanges cut off are most frequently used in practice (OST 7688).

5. ON GRADE OF THE GRATE

The grate is usually set at a 0.1 grade. Horizontal grates are not advisable (although they have a larger discharge coefficient than the sloped ones), because gravel clogs them more often than the sloped grates; this is corroborated by the operational data of the Yegun-arkh River dam, where a horizontal grate has been

CONFIDENTIAL

CONFIDENTIAL

installed. On the Bol'shaya Almatinka River Dam, the grate was given, after repair, a 0.023 grade (instead of the former 0.1 grade). This was done to increase the height of the trough, from which a better intake capacity was expected. These expectations proved to be wrong; instead, due to the insignificant grade of the grate, stones began to stick in the grate at times when water flowed over it in a thin layer.

6. ON THE DRIFT-INTERCEPTING COLLECTOR

At the Bol'shaya Almatinka River dam, a special ground drift intercepting collector has been built in front of the water-intake trough, 1.7 meters off the axis of the trough (Figure 3). The collector has a cross-section of 30 by 40 centimeters which is semicircular at the bottom. Its channel is sloped towards the left separation buttress, where a round tube 300 millimeters in diameter was installed to lead drifts into the tailwater (Figure 4). Within the first half hour after water was let over the dam, this collector had already become drifted up with sand (these data were obtained by the author from Engineer Rastokuyev). One of the reasons for this sedimentation can be seen in the installation of the discharge tube in a joint at a right angle to the axis of the collector, which resulted in the accumulation of foreign matter starting from the bend point. During dam repair work in July 1950, this collector, being out of operation, was filled out with concrete. Clogging of a similar collector has also taken place at a river dam in Tadzhikistan (L. A. Gorbachev, "Tyrolean Water Intake for Catastrophic Floods Drifting Eroded Matter from Denuded Soil,"

CONFIDENTIAL

CONFIDENTIAL

Hydrotechnical Constructions, number 12, 1947).

To obtain improved flushing of foreign matter by creating a spiral current in the collector, the Armenian Trust for Rural Electrification designed a collector ingress of the ground gap type, as suggested by I. T. Kolesnikov (I. T. Kolesnikov, "Flushing Trough with Spiral Water Current," Hydrotechnical Construction, number 7, 1940). At the dam which is being constructed after this project, buttresses of the grate section will have apertures with cross-sections of 10 by 20 centimeters; these apertures will be connected with the flushing trough, which leads from the collector into the tailwater (Figure 9). These apertures, located above the dam ridge, will take in, at the time of flood, an additional water discharge, which will better convey the drifts down the flushing trough.

7. ON ICING OF GRATES

Another deficiency of the described type of water-intake constructions is that grate interstices become clogged with sludge ice during the cold season. In the headwater of the Bol'shaya Almatinka River dam, ice forms along the river banks. Pieces of this ice which are torn away by water, stick in the grate, regelate with the sludge, and cover the grate with ice. The icing of grates occurs with such intensity that even continuous cleaning cannot keep far enough ahead of the clogging of the interstices as to allow water to enter the trough. According to

CONFIDENTIAL

CONFIDENTIAL

Comrade Lustov, an operation attendant at this dam, as an experiment a grate was installed with 80-100 millimeter interstices; however, no positive effect has been achieved, inasmuch as the grate interstices became clogged with sludge. Therefore, in wintertime, water intake is effected through the headwater aperture of the flushing sluice.

Wintertime operational data on such constructions indicate that, prior to development of effective measures against the clogging of grates by sludge, such constructions must be provided with special apertures, such as by-pass to the water-intake trough to supply the canals with water.

CONFIDENTIAL

CONFIDENTIAL

LEGENDS *[Note: Figures 1-9 are on the next page.]*

Figure 1. Schematic Plan of the Dam - (dimensions in meters)

Figure 2. Grate Section in Lifted Position.

Figure 3. Cross-Section of the Water-Intake Trough.

Ground Drift Intercepting Collector.

Figure 4. Cross-Section Along the Axis of the Water-Intake Trough
at the Bol'shaya Almaatinka River Dam.

Left Flushing Chamber

Discharge Tube of the Drift Intercepting Collector.

Level of Water Flowing over the Trough

Separation Buttress.

Tailwater Gates of the Right Flushing Chamber

Figure 5.

Figure 6.

Figure 7. Grate.

Ground Aperture.

Figure 8. Cross-Sections of Grate Rods.

Dimensions in Millimeters.

Figure 9. Flushing Collector of the Ground Gap Type.

Cross-Section Along 1 - 1

Smooth Concrete Surfaces.

Cross-Section Along 2 - 2

CONFIDENTIAL

Water-Intake Trough.



- END -

Continued

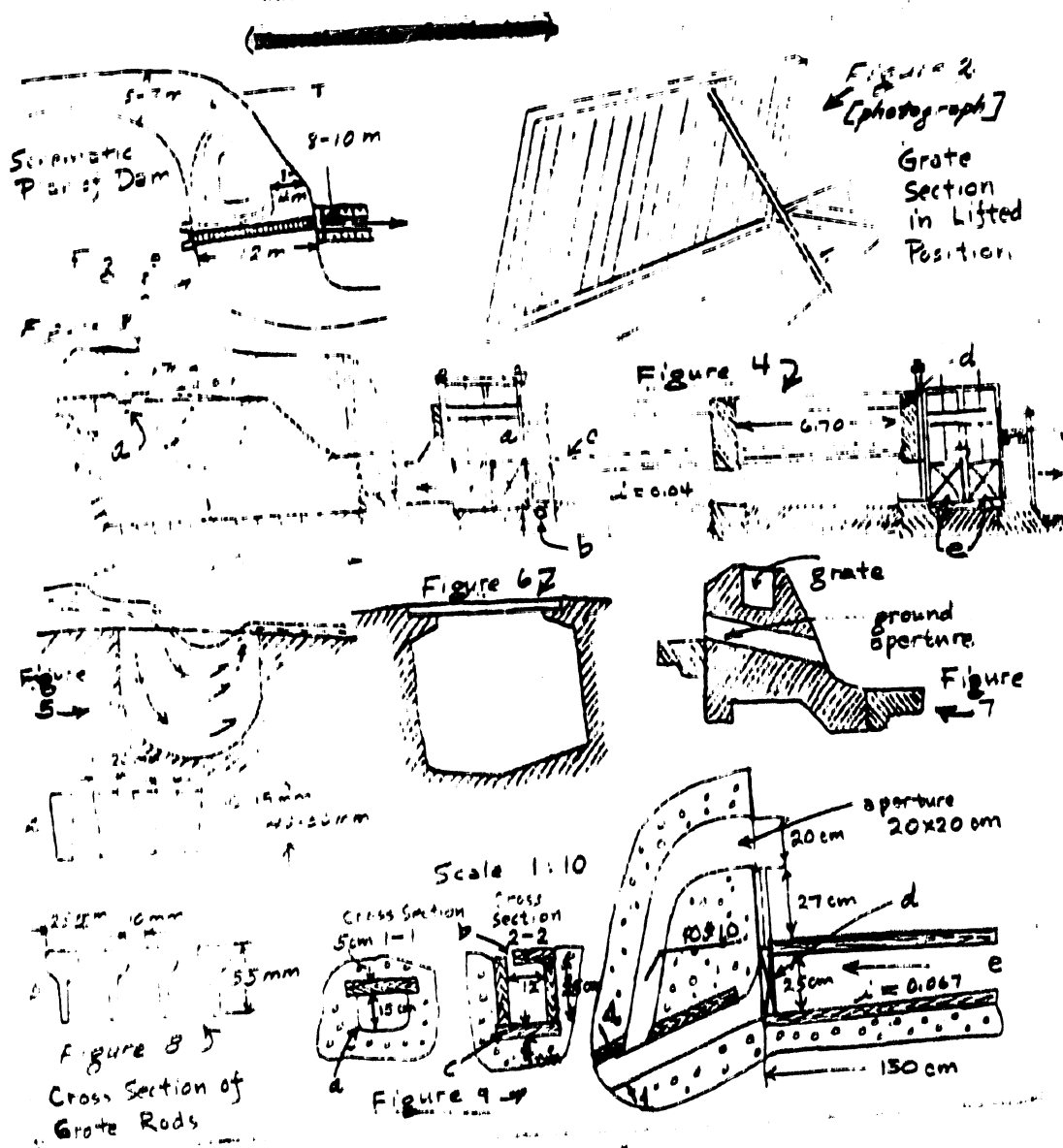
Ground Gap.

Planks 5 by 20.

Aperture 20 by 10.

Gate.

Water-Intake Trough.



- 16 -

- END -

50X1-HUM

~~RESTRICTED~~

C I A

FOREIGN DOCUMENTS DIVISION

9 Oct 1951

50X1-HUM

Table of Contents of the Soviet Periodical "Journal of General Chemistry"

Vol. X, No. 1, 1940

Zhurnal Obshchey Khimii
Moscow, 1940

/ This report has not been edited
or prepared for publication. /

RESTRICTED

10032.

JOURNAL OF GENERAL CHEMISTRYVol. X (LXXII), No 1, 1940

"The Speeds of Hydrogenation of Aromatic and
Unsaturated Hydrocarbons." Part IV

A. V. Iosevov and M. K. D'yakova

Institute of Mineral Fuels, Academy of Sciences USSR

Received 17 July 1939

"The Viscosity of the Ternary Systems: Phenol-Aniline-
Benzene, Phenol-Dimethylaniline-Benzeneⁿ, and
Phenol-Diethylaniline-Benzene"

V. V. Udevenko and A. P. Teronov

Laboratory of Physical Chemistry of the Central

Asiatic State University

Received 5 June 1939

"Cryoscopic Examination of the Phenol-Aniline,
Phenol-Dimethylaniline, and Phenol-Diethylaniline
Systems"

Laboratory of Physical Chemistry of the Central Asiatic

State University

Received 25 July 1939

"Polarographic Analysis of Mixtures of Aldehydes and
Peroxides"

V. Shtern and S. Poliyak

Scientific-Research Institute of Chemical Physics.

Leningrad

Received 29 July 1939

"The Catalytic Conversions of Heterocyclical
Compounds"

Part XV. "The Life of the Catalytic Agent in
the Reactions of the Conversion of Furanidine
into Pyrrolidine and Thiophane. The Optimum
Conditions for the Conversion of Furans into
Thiophane"

Mu. K. Mur'yev and V. A. Tronova

Laboratory of Organic Chemistry imeni Academician

N. D. Zelinskiy of the Moscow State University

Received 29 July 1939

"Obtaining Complex Esters in the Presence of
Magnesium Chloride"

P. A. Petyunin

Laboratory of Organic Chemistry of the Perm Medical
Institute

Received 2 August 1939

"The Derivation and Properties of α - and β -Naphthyl-
Glyoxals"

L. N. Goldyrev and I. Ya. Postovskiy

Laboratory of Organic Chemistry of the Ural ~~Indus~~

Industrial Institute imeni S. M. Kirov

Received 9 August 1939

"The Phenomena of Chromaticity on the Nitrocinnamoyl
Derivatives of Aromatic Amines"

Part X. "Isolated Auxenoid Systems"

Ye. A. Smirnov

Laboratory of Organic Chemistry of the Moscow

State Pedagogical Institute imeni K.

Lil'mekht

Received 9 August 1939

"The Derivatives of Naphthyl- and Tetrahydronaphthyl-
oxamino Acids and the Derivation of
4-Nitro-1-Aminonaphthalene"

S. I. Sergiyevskaya

All-Union Scientific-Research Chemical-Pharmaceutical

Institute imeni Serge Ordzhonikidze

Received 14 August 1939

"Examination of the Acid of the Milky Juice of the
Spurge Euphorbia Biglandulosa Desf." Part III.

N. P. Kriv'yalov
Chem. Lab. of the Dep't of Plant Material, Botan. Inst., Acad. Sci. USSR
Received 2 August 1939

"The Chemistry of Carcinogen Compounds"
Part I. "The Syntheses of 9-Azacholanthrene and
Several Meso-Alkylated 1,2- and 3,4-Benzacridines"

I. Ya. Postovskiy and B. N. Lundin

Laboratory of Organic Chemistry of the Ural ~~VNIIP~~

Industrial Institute imeni S. M. Kirov

Received 3 August 1939

"The Problem of the Magnesium Synthesis of Unsaturated
Halogen ~~(acetylenone, propadiene, etc.)~~ Alcohols having
Double Bonds"

G. I. Shtukin

Laboratory of Organic Chemistry

Kiev University

Received 4. August 1939

"The Electrocapillary Method of Qualitative
Analysis"

S. I. D'yachkovskiy and A. F. Orlenko

Laboratory of Inorganic Chemistry

Gorkiy State University

Received 19 August 1939

JOURNAL OF GENERAL
CHEMISTRY

Vol X (LXXII), No 2, 1940

"Acoustical Electrochemical Phenomena"

Part III. "Causes for the Reception of Sound
by Polarized Electrodes"

L. V. Nikitin

Leningrad Institute of Precision ~~Mechanics~~ Mechanics
and Optics

Received 19 May 1939

"Acoustical Electrochemical Phenomena"

Part IV. "Characteristics of the Reception of
Sound by Semi-Permeable Membranes"

L. V. Nikitin

Leningrad Institute of Precision Mechanics and
Optics

Received 19 May 1939

"The Coagulation of Colloids by Means of Electro-
lytes"

Part XIII. "The Electrochemical Properties and the
Coagulation of Monodispersed Silver Sols"

M. Ye. Sh^hniashvili and A. I. Rabinovich

Chemical Institute of the Georgian Affiliate of
the Academy of Sciences USSR, and the
Physico-Chemical Institute imeni L. Ya.

Karpov

Received 27 June 1939

"The Coagulation of Colloids by Electrolytes"

Part XIV. "The Electrostatic Theory of Coagulation
and the Limits of its Application to Silver
Sols"

A. I. Rabinovich and M. Ye. Shishniashvili
Chemical Institute of the Georgian Affiliate of
the Academy of Sciences USSR and the
Physico-Chemical Institute imeni L. Ya.
Karpov

Received 27 June 1939

"Study of the Sorption and Catalytic Properties
of Active Manganese Dioxide Relative to
Vaporous and Gaseous Substances"

Part III. "The Formation of Nitrogen Oxides on
Active Manganese Dioxide"

Ye. V. Alekseyevskiy and V. B. Aleksovskiy
(No institute or other affiliation indicated.)

Received 21 June 1939

"The Action of Sulfuric Acid on Petroselic Acid"

A. A. Chernoyarova
Laboratory of Organic Chemistry
Novocherkassk Industrial Institute

Received 17 July 1939

"The Synthesis of Hexyl Phenyl Acetylenyl Carbinol"

N. Malenok and I. Sologub
Chair of Organic Chemistry
Minsk State Medical Institute

Received 2 July 1939

"The Polymorphic Structures of Titanium Dioxide"

Part XV. "The Chemistry of Titanium"

A. V. Pamfilov and Ye. G. Ivanchova

Laboratory of Inorganic Chemistry

Belorussian State University

Received 7 July 1939

"The Maximum Valence of the Elements of Group VIII
of the Periodic System of Elements"

B. Ormont

Laboratory of Complex and Heavy Compounds

Physico-Chemical Institute imeni L. Ya. Karlov

Received 11 June 1939

"The Problem of the Electrochemical Oxidation of
Cobalt"

E. S. Mitselovskiy and B. F. Ormont

Laboratory of Complex and Heavy Compounds

Physico-Chemical Institute imeni L. Ya. Karlov

Received 3 July 1939

"Transformations of the Higher Order of Urea"

"Study of the Temperature ~~Amplification~~ Expansion
(~~rasshireniya~~) of Urea"

V. A. Sokolov

(No affiliation given.)

Received 11 July 1939

"Isomerization of Polymethylenic Hydrocarbons
under the Influence of Aluminum Chloride"

Part V. "Isomerization of n.-amyleyclopentane"

M. B. Tureva-Polyak and G. A. Tarasova

Laboratory of Organic Chemistry Imeni Academician

N. D. Zelinskiy

Moscow State University

Received 11 July 1939

In memory of
~~"Recommendations"~~ of Academician P. P. Shorygin

S. N. Danilov

JOURNAL OF GENERAL CHEMISTRY

Vol X(LXXII), No 3, 1940

"The Dehydration of Some Homologs of Cyclopentanol"

Part III.

Ya. I. Denisenko and A. D. Haber

Institute of Organic Chemistry

Academy of Sciences USSR

Received 2 August 1939

"The Chemiluminescence of Hydrazides of Carboxylic
Acids" Part II.

Ye. S. Vasserman and G. F. Miklukhin

Dnepropetrovsk Chemico-Technological Institute

Received 25 July 1939

"Research in the Field of Cyclones"

V. S. Abramov and Ts. L. Mitropolitanskaya

Laboratory of Organic Chemistry

Kazan' Chemical Scientific-Research Institute imeni

A. M. Butlerov

Received 17 July 1939

"The Kinetics of the Formation of Titanate of Lead"

A. V. Pamfilov and K. S. Fridman

Laboratory of Inorganic Chemistry

Belorussian State University

Received 7 July 1939

" $\Delta^{4,5}$ -6-Methyl~~Androstendione~~-3,17"

O. S. Madayeva, M. I. Ushakov and N. F. Keshcheleva
Laboratory of the Chemistry of Steroids
All-Union Institute of Experimental Medicine and

A. M. Gorkhly

Received 17 July 1939

"The Problem of Computing the Titrable Acidity
according to the Sum Total of Hydrogen
Ions"

P. S. Zhelazkov

The All-Union Scientific-Research Institute of
the Refrigeration Industry
Moscow

Received 3 August 1939

"The ^{Nitrating} Nature of ~~Nitrant~~ Mixtures". Part I.
M. Usanovich

Laboratory of Physical Chemistry
Central Asiatic State University

Received 21 July 1939

"The Nature of ^{Nitrating} ~~Nitrant~~ Mixtures"

Part II. "Nitration of Toluene in the Presence of
Acetic Acid and Nitrobenzene"

M. Usanovich and Sh. Abidov

21 July 1939

Laboratory of Physical Chemistry
Central Asiatic State University

^{Nitrating}
 "The Nature of ~~Nitrant~~ Mixtures"

Part III. "The Nitration of Toluene in the Presence
 of Sulfuric and Trichloroacetic Acid"

M. Usanovich and I. Gludkov
 Laboratory of Physical Chemistry
 Central Asiatic State University
 Received 21 July 1939

^{Nitrating}
 "The Nature of ~~Nitrant~~ Mixtures"

Part IV. "The Nitration of Toluene in the Presence
 of Monochloroacetic Acid and Ethyl Nitrate"

M. Usanovich and T. Sushkevich
 Laboratory of Physical Chemistry
 Central Asiatic State University
 Received 21 July 1939

"The Apparent Gram-Molecular Volumes of Salts in
 Ammoniacal and Aqueous Solutions"

Ye. I. Alkhimov

Part I. ~~Theoretical~~

Received 26 August 1939

"The Action of Diazobenzene on Alkylacetylacetic
 Esters as a Means of Obtaining the
 Phenylhydrazones of α -Ketonic and α -Amino
 Acids"

Part I. "Synthesis of ~~the~~ Isoleucine and ~~the~~
 Leucine"

V. V. Fed^filakto^fv

Laboratory of Albumen, Academy of Sciences USSR
 Received 29 August 1939

"The Action of Diazobenzene on Alkyl Acetylacetic
Esters as a Means of Obtaining the
Phenylhydrazones of α -Ketonic and α -Amino
Acids"

Part II. "The Synthesis of Phenylalanine"

V. Feofilaktov and Ye. Vinogradova

Laboratory of Albumen

Academy of Sciences USSR

Received 29 August 1939

"The Action of Diazobenzene on Alkyl Acetylacetic
Esters as a Means of Obtaining the
Phenylhydrazones of α -Ketonic and α -Amino
Acids"

Part III. "The Synthesis of Alanine"

V. Feofilaktov and V. Zaytseva

Laboratory of Albumen

Academy of Sciences USSR

Received 29 August 1939

"The Synthesis of ^{the} Phenylhydrazine of Phenylpyruvic
Acid from ~~the~~ Benzylmalonic and
Benzilycyanacetic Esters" Part IV

V. Feofilaktov and Ye. Vinogradova

Laboratory of Albumen

Academy of Sciences USSR

Received 29 August 1939

"A New Method of Obtaining Certain Iodomethylates
of Derivatives of Quinaldine"

V. A. Alekseyeva

Laboratory of Organic Chemistry
 Dnepropetrovsk Chemical-Technological Institute
 Received 8 October 1939

"Anhydrous Analogs of Ferric Alums"

N. V. Shishkin

Laboratory of Physical Chemistry

Saratov State University

Received 29 June 1939

"Polymethinic Dyes of the 3-oxythionaphthene Series"

Part I. "The Condensation of 3-oxythionaphthene
 with the N,N'-diphenylformamidine and the
 Dianyls of Malonic and Glutaconic Aldehydes"

N. N. Sveshnikov and T. I. Levkoyev

Scientific-Research Cinematic and Photographic
 Institute

Moscow

Received 10 September 1939

"Vladimir Nikolayevich Krestinskiy"

(8 April 1882 - 22 October 1939)

N. S. Poshkarova

JOURNAL OF GENERAL CHEMISTRY

Vol X (LXXII), No 4, 1940

"The Viscosity of the Liquid Ammonia - Ethyl
Alcohol System"

A. Murtasayev and Z. Sklyarova

Laboratory of Physical Chemistry of the Central
Asiatic State University

Received 13 September 1939

"The Effect of Cane Sugar on the ~~Viscosity~~ ^{Conductivity} Number,
The Electroconductivity, the Viscosity
and the Concentration of Hydrogen Ions
in Solutions of Hydrochloric Acid"

I. I. Zhukov and G. F. Dneprov

Laboratory of Physical Chemistry
Scientific-Research Chemical Institute

~~Leningrad~~ Leningrad State University

Received 1 July 1939

"The Composition of the ~~Residues~~ ^{Deposits} (residues) formed
during the Reaction of Solutions of
~~Potassium Orthophosphate~~ ^{Potassium Orthophosphate}
~~Tripotassium Phosphate~~ and Magnesium
Chloride"

A. N. Agte, P. A. Arkhangel'skiy and N. I. ⁱBarger

Laboratory of Qualitative Analysis
Leningrad Chemico-Technological Institute

Received 28 May 1939

"Nitrous Compounds of Mercury as Exciters of the
Chemical Activity of Selenium. The Role
of These Compounds in the Formation of Azo
~~Compounds~~ Compounds, Azines and Dyes from
Aromatic Amines under the Action of Sulfur
and Selenium"

P. S. Pishchinskaya

Laboratory of Organic Chemistry

Khar'kov Agricultural Institute

Received 1 July 1939

"The Action of Metals on the Water of Crystallization
of Crystal Hydrates"

Part I. "The Action of Metallic ^{Aluminum} ~~Al~~ on the Water
of Crystallization"

V. I. Semishin

Laboratory of General and Inorganic Chemistry

Moscow Chemico-Technological Institute imeni

Mendeleev

(No date of reception.)

"The Action of Metals on the Water of Crystallization
of Crystal Hydrates"

Part II. "The Action of Metallic Zinc on the Water
of Crystallization"

V. I. Semishin

Laboratory of General and Inorganic Chemistry

Moscow Chemico-Technological Institute imeni

Mendeleev

Received 23 July 1939

"The Action of Metals on the Water of Crystallization
of Crystal Hydrates"

Part III. "Some General Problems of the Structure
of Crystal Hydrates and Their Properties"

V. I. Semishin

Laboratory of General and Inorganic Chemistry
Moscow Chemico-Technological Institute named
Mendeleev

Received 25 August 1939

"The Complex Ion in Solutions Containing Manganese
and Ammonium Salts"

R. I. Agladze

Moscow Chemico-Technological Institute named

D. I. Mendeleev

Received 17 July 1939

"The Reaction of Hydrogen Sulfide with Sulfites"
I. "The Formation of ^{Sodium} Dithionate by the Action of
Hydrogen Sulfide on Sulfite Solutions and
Sodium Bisulfite"

Ya. I. Zil'berman and V. M. Fridman

State Institute of Applied Chemistry

Received 19 September 1939

"The Change in the Microstructure and the Crystalline-
Optical Properties of Gypsum during its
Calcination"

V. I. Serdyukov

Ivanovo Chemico-Technological Institute

Received 17 August 1939

"The Dependence of Crystal Structure on Chemical
Properties"

I. I. Zaslavskiy

Ivanovo Chemical-Technological Institute

Received 16 August 1939

"Hydrates of Chromic Oxide"

S. I. D'yachkovskiy and V. K. Rubtsova

Laboratory of Inorganic Chemistry

Gorkiy State University

Received 19 September 1939

Journal of General Chemistry

Vol X (LXXII), Nos 5-6, 1940

"The 80th Birthday of Academician A. Ye.
Pavarskiy"

"An Outline of his 55 Years of Scientific
Pedagogical Activity"

S. H. Danilov

"The Problem of Obtaining a Semicyclical Double
Bond in a ^{Three-member} ~~Triangular~~ (triangular) Cycle"

Part I. "An Attempt to Obtain Methylene-Cyclopropane
by the Action of Zinc Powder on 3-Chloro-2-
Chloromethylpropane-1 in an Alcohol Solution"

I. A. D'yakonov

Laboratory of Organic Chemistry

Scientific-Research Chemical Institute of the

Leningrad State University

(No date of reception.)

"The Problem of Obtaining a Semicyclical Double
Bond in a ^{Three-member} ~~Triangular~~ Cycle"

Part II. "The Action of Phosphorous Pentachloride
on Acetylcyclopropane"

I. A. D'yakonov

Laboratory of Organic Chemistry

Scientific-Research Chemical Institute of the

Leningrad State University

(No date of reception.)

"The Study of Tertiary Acetylenyl Carbinols in which
the Acetylene Hydrogen has been Replaced by
a Haloid"

T. D. Nagibina

Laboratory of Academician Favorskiy

Institute of Organic Chemistry

Academy of Sciences USSR

(No date of reception.)

"The Electrolytic Hydrogenation of Dimethylvinyl Acetyl-
enyl Carbinol"

A. P. Golovchanskaya

Laboratory of Organic Chemistry

Chemical Institute of the Leningrad State University

From her dissertation for the degree of Candidate in
Chemical Sciences, defended in March 1939.

"Research in the Field of Isomer Conversions of
Unsaturated Haloid Derivatives of the
Aliphatic Series"

Part III. "The Action of Hydrochloric Acid on
Methyl Ethyl Acetylenyl Carbinol in the Presence
of Ammonium Chloride and Cuprous Chloride"

T. A. Favorskaya and A. I. Zakharova

Laboratory of Organic Chemistry

Scientific-Research Chemical Institute of the

Leningrad State University

Undated

"Research in the Field of Isomer Conversions of
Unsaturated Haloid Derivatives of the
Aliphatic Series"

Part IV. "The Action of Hydrochloric Acid on
Diethyl ~~Acetylenyl~~ Carbinol in the Presence of
Cupric or Cuprous Chloride and Ammonium
Chloride"

T. A. Favorskaya and I. A. Favorskaya
Laboratory of Organic Chemistry
Scientific-Research Chemical Institute of the
Leningrad State University
Received 23 May 1939

"Research in the Field of Isomer Conversions of
Unsaturated Haloid Derivatives of the
Aliphatic Series"

Part V. "The Reaction of Dimethyl ~~Acetylenyl~~ Carbinol
with Hydrobromic and Hydroiodic Acids"

T. A. Favorskaya
Laboratory of Organic Chemistry
Scientific-Research Chemical Institute of the
Leningrad State University
Undated

"Research in the Field of Isomer Conversions of
 α -Ketone Alcohols"

Part II. "The Interrelation between Phenylacetyl-
and Methylbenzoyl Carbinols"

T. I. Temnikova
Laboratory of Organic Chemistry
Scientific-Research Chemical Institute of the
Leningrad State University
Undated

"The Synthesis of Acetylene γ -Glycols of
Asymmetrical Structure"

A. T. Babayan

Chemical Institute of the Armenian Affiliate of
the Academy of Sciences USSR

Undated

"The Influence of Radicals on Isomer Conversions
of Tertiary α -Keto-alcohols"

"Part III. The Influence of α -naphthyl"

A. M. Khaletskiy

Laboratory of Organic Chemistry

Scientific-Research Chemical Institute of the

Leningrad State University

Undated

"The Isomerization of Oxyaldehydes"

Part VII. "The ^{Regrouping} ~~Conversion~~ of Galactose into
Galactodesonic Acid"

A. M. Gakhokidze

Laboratory of Chemistry

Tbilisi Pedagogical Institute

Undated

"The Isomerization of Oxyaldehydes"

Part VIII. "The Conversion of β -Arabinose into
 β -Arabosaccharinic Acid"

A. M. Gakhokidze

Laboratory of Chemistry

Tbilisi State University

Undated

"Research in the Allene Series"

Part I. "A New Method of Obtaining Allenic
Hydrocarbons"

Ya. I. Ginzburg

Laboratory of Chemistry of High-Molecular Compounds

Imeni Academician S. V. Lebedev

Leningrad State University

Undated

"The Fixation (~~on isocyanide~~) of Bromine and Chlorine to 2,3-Diphenylbutadiene"

Ku. S. Zal'kind and P. Mosunov

From the Laboratory of Organic Chemistry of the

Pedagogical Institute Imeni Gertsen

Undated

"The Fixation of Hydrogen on Acetylene Derivatives"

Part XXXII. "The Catalytic Hydrogenation of Alcohol

having a Triple and Double Bond"

Ku. S. Zal'kind and N. D. Khudokova

From the Laboratory of Organic Chemistry of the

Pedagogical Institute Imeni Gertsen

Undated

"On the Theory of the Nitration of Cellulose"

S. M. Danilov, V. M. Matveyev and V. I. Buldgalter

Laboratory for the Chemical Treatment of Cellulose

Leningrad Chemical-Technological Institute

Undated

"The Condensation of $SiCl_4$ with Diatomic Phenols"

Ku. N. Vol'nov and B. N. Dolgov

Laboratory of Organic Chemistry

Leningrad State University

Undated

"Research in the Field of Tautomer Compounds"

Part I. "Certain Isoxazolonics ^{and Oxazolonics} Derivatives"

A. Ye. Poray-Koshits and N. V. Khromov

Laboratory of Dyestuffs
Leningrad Chemical-Technological Institute
Received 20 January 1940

"Secondary and Tertiary Arylamines Containing
a Furfuryl Group"

Part I. "Phenylfurfurylamine and Ethylphenylfurfurylamine"

A. I. Umnova

Laboratory of Organic Chemistry

Leningrad State University

Undated

50X1-HUM

Proj: 1004

C I A

POPULAR DOCUMENTS DIVISION

27
3 Oct 1951

50X1-HUM

Comments on 29 Meteorological books, used for
supplementary reading in middle school courses on Meteorology.

Meteorologiya v sredney shkol'e
[Meteorology in the Middle School]
S. N. Zhurkov, Moscow/Leningrad, 1948.

[This report has not been edited or prepared for publication.]

CONFIDENTIAL

COMMENTS ON 29 METEOROLOGICAL BOOKS, USED FOR SUPPLEMENTARY
READING IN MIDDLE SCHOOL COURSES ON METEOROLOGY

S. N. Zharkov

Note: The following report was obtained from the Bibliographic Section, pages 98 to 105, of the 112-page brochure entitled *Meteorologiya v Sredney Shkole* (Meteorology in the Middle School). It was published 1948 in Moscow and Leningrad by the Academy of Pedagogical Sciences Press as part of the general series entitled 'Pedagogical Library for the Teacher', which is prepared in the Institute of Methods of Instruction, within the Academy of Pedagogical Sciences USSR. The author of this brochure is S. N. Zharkov.⁷

Nobody will deny that it is very desirable to provide students with popular books on meteorology for independent reading, although we have to acknowledge with great regret that the kinds of books that are prepared for students of middle schools are very scarce. Such books have scarcely been published during recent years. Therefore we should bear in mind previously published books, assuming that such books should be available in libraries, included school libraries

Among old books we are reminded of two books, which may serve the teacher as an example of an elementary but at the same time strictly scientific presentation of serious and at the same time colorful exposition of meteorological knowledge:

1. Camille Flammarion. *Atmosphere*, popular meteorology; translation from French, St Petersburg 1900, 626 pp

- 1 -

CONFIDENTIAL

CONFIDENTIAL

This is an extremely interesting book, due to the love which the author feels for nature, lingering particularly on beautiful phenomena of nature. The reading of this book in presence of other people may develop their interest in meteorology and natural phenomena. The book is outstanding for its mastery of expression and is very well illustrated.

2. A. I. Veyeykov. Meteorology, for middle schools and for practical life; St Petersburg, 1914, 187 pp.

This condensed, popular manual of meteorology by Veyeykov is one of the best. Its contents embrace the whole science of meteorology, because he outlines magnetic, electric and light phenomena, the characteristics of local weather and the methods of meteorological measurements. This book may be strongly recommended as an example of condensed but lucid exposition.

Among books for independent reading by students of middle schools we may choose the following:

1. S. N. Zharkov. Popular and Scientific Indications of Weather, Moscow, 1927, 87 pp.

The peculiarity characterizing this book is the analysis of popular beliefs concerning weather, for the purpose of giving an objective evaluation of the matter and allowing the reader to distinguish consciously between beguiling signs and those inspiring confidence.

2. V. A. Mikhelson, Professor. Weather and How to Forecast It, State Press, 1928, 76 pp.

CONFIDENTIAL

CONFIDENTIAL

The book is distinguished by its elementary and very clear and easy understandable description and by the small amount of discussed problems, all concentrated on one topic; namely the forecasting of weather according to local observations of clouds and wind. The book also contains a description of meteorological instruments. The chapter describing the average monthly behavior of the weather in the environs of Moscow, as an example, of a study of local weather, is particularly useful for social circles.

3. V. N. Obolenskiy, professor. Brief Course of Meteorology, State Scientific Technical Press, Leningrad, 1932, 122 pp.

The book is one of the most recent publications of a brief course of meteorology. The description is sufficiently simple, constructed in a somewhat original way: the whole text is divided into three topics: thermal phenomena in the atmosphere; circulation of moisture in the atmosphere; the weather and its forecast. Furthermore, it is divided into 16 problems as in manuals.

4. D. O. Gvyatskiy and A. P. Klado. Interesting Meteorology, Leningrad, 1935, 268 pp.

This book belongs to a series of "interesting" or popular (diverting) books, relating to most diverse branches of sciences. This fact limits the choice of material and, most important, the type and style of description. As reading matter this book is most recommendable.

- 3 -

CONFIDENTIAL

CONFIDENTIAL

5. V. S. Samoylenko. Why Does the Weather Change and What are the Signs, Moscow, 1942, 30 pp.

The first and smaller portion of this book outlines recent hypothesis concerning essential weather phenomena (aerial masses and fronts); the second portion discusses scientific local weather signs and their application to forecasting. The term of the title explains the method of description.

6. B. L. Dzerzhevskiy. The Aerial Ocean, Moscow, 1946, 40 pp.

The booklet belongs to the Popular Science Library Series published by the State Technical Press and outlines in an elementary and popular form "what is the surrounding air and what are the most important phenomena occurring in it".

7. I. M. Yaroslavtsev. Local Weather Signs, Moscow, 1946, 22 pp.

The book gives an account of a rather large number of local signs of steady weather, amelioration or deterioration of weather and some separate phenomena. In order to gain popularity the illustrations are of extreme vulgarity; for example: various faces on clouds, weeping sun, falling barometer as a falling man, the arctic air as old man winter, warm air as a running sportsman, a storm whirl as a ghost from Arabic fairy tales etc. All this does not give the impression of serious work,^{but} rather reminds us of a book for little children, although the explanation of local signs is expressed in scientific language.

CONFIDENTIAL

8. I. S. Stekelnikov. Lightning and Thunder, Moscow 1946, 40 pp.

This book belongs to the same series as Aerial Ocean by Dzezevskiy. After some introduction on electricity the author deals with the problem of lightning and thunder from the view point of modern scientific knowledge; further he describes actions performed by lightning and terminates on an outline of protections against lightning.

9. A. P. Galstov. The weather and Its forecasting, Moscow, 1947, 64 pp.

Three quarters of the book are devoted to the explanation of what is weather and to the description of basic physical phenomena creating the weather; for example: atmospheric motion, atmospheric pressure and wind, aerial masses and fronts. The last quarter of the book describes local weather forecastings and the modern weather service. The description is popular, but serious.

More books can be pointed out for the teacher than for students, because scientific books in meteorology have recently been published in great number, as well as even during the war.

Among general manuals on meteorology we may notice the following.

1. K. M. Benua. Meteorology, Leningrad, 1941, 503 pp.

The first part of the book gives basic information on the atmosphere and the physical processes occurring in it. The second part is devoted to the basic knowledge of weather according to modern sciences. The book is

CONFIDENTIAL

CONFIDENTIAL

written in an elementary way and is accessible to school teachers, although it may be recommended as a scientific manual for higher navy schools. This meteorology manual appears to be the best.

2. Ye. V. Valchenko. General Meteorology, Leningrad, 1947, 352 pp.

This book is a manual for technical schools of hydrometeorology and contains three parts: real meteorology, climatology and aerology, or methods of study of the free atmosphere. In order to place the whole necessary material in the confines of one book, the author had to make brief descriptions which give the book sometimes the appearance of a condensation. Otherwise the book does not possess any distinction of originality and reminds one of the usual previously published courses on meteorology.

3. Sverre Petterssen. Introduction to Meteorology, translation from English, Moscow 1947, 279 pp.

The author considers his book a popular manual which may be used in the numerous meteorology courses offered in the USSR. The book describes in elementary fashion the basic principles of modern meteorology, and its purpose is to excite the reader's interest in the subject. For this reason the book is less devoted to technical and detailed discussion of various branches of meteorology. However the book has a certain inclination to synoptic and flying meteorology, but is not intended for specialists. The whole text is kept on modern scientific level. The description is condensed and strictly scientific.

CONFIDENTIAL

CONFIDENTIAL

In the absence of general courses on meteorology, manuals for special higher educational institutions may be used; in such manuals some questions may be described in less detail or may be entirely omitted; however fundamentals of meteorology are included in all such books, among which we may mention:

1. A. A. Kulakov and V. A. Shtal. Military Meteorology, a manual for students of military academies of the Red Army, Moscow, 1940, 200 pp.

The book discusses the effect of atmospheric conditions on combat activities of troops and the application of tactical techniques, as well as meteorological security of troops.

2. V. I. Frishletsov. Geophysics, a manual for cosmic higher educational schools, Moscow, 1946, 320 pp.

The special purpose of the book required a more detailed treatment of chapters on barometric leveling, terrestrial magnetism and the structure of the terrestrial sphere.

Among books devoted to a special problem, it is necessary to point out books that outline synoptic meteorology on the level of the modern state of science and help the reader to assimilate scientific methods of weather forecasting. Such textbooks are:

3. S. F. Karel'skiy. Weather and its Forecasting, Moscow, 1937, 103 pp.

The author expounds in a popular way the causes of weather changes and clarifies fully the techniques for compilation of synoptic maps and their application. Among books of similar content this manual is the most elementary and popular.

- 7 -

CONFIDENTIAL

CONFIDENTIAL

4. A. V. Kunits. Synoptic Meteorology, Moscow, 1947, 323 pp.

The book is intended for technical schools of hydrometeorology. The main part of the book is devoted to the study of laws governing the development of physical processes in the atmosphere and the lesser part is devoted to synoptics and weather forecasting. The exposition, although somewhat more serious than the foregoing books, is still popular.

5. A. M. Kurgan. Essay on Development of Meteorology, Leningrad, 1948, 351 pp.

The editor states that this book systematically outlines materials on the development of ideas, methods of investigation, and scientific theories in the matter of man's conception of phenomena, properties and laws of the earth's aerial envelop (the atmosphere) beginning at remote antiquity and ending in recent times. The expounded material does not analyze the historical course of meteorology along with the general progress of science, as related to social developments. The accumulation of factual materials leads to a sudden discovery of a new law or to the appearance of a new idea effecting a revolutionary modification in science. Several such revolutions occurred in the history of meteorology. Such stages are not emphasized enough in the "Essay" and this appears to be a serious deficiency of the considered work." This book deserves study as the only Russian language book on the history of meteorology.

CONFIDENTIAL

CONFIDENTIAL

In monographs devoted to some particular meteorological problem the teacher may always find some convenient material for clarifying weather phenomena. Rather many such monographs exist, among which the following may be recommended.

1. V. A. Khanevskiy. Light Phenomena in the Atmosphere, Moscow, 1930, 66 pp.

Although this book was published long ago, we nevertheless mention it here because we lack at our books on atmospheric optics and the excellent course on it is problem by Professor Brownov is a bibliographic rarity. The booklet by Khanevskiy is part of school library: for this reason the booklet contains many problems for independent solutions by students.

2. M. V. Polobkov. Storms and Squalls, Moscow, 1930, 220 pp.

The book describes many interesting details that characterize rather thoroughly certain weather phenomena; namely, storms and squalls, which play an important role in our people's agriculture and cause enormous losses.

3. G. D. Fikhter. The Snow Blanket, its formation and properties, Moscow, 1945, 120 pp.

The snow blanket is one of the most common phenomena of nature; snow is accessible to study by everybody, and besides possesses most various aspects and provides rich material for independent investigation by students. In this book the teacher will find an endless supply for organized study projects.

CONFIDENTIAL

CONFIDENTIAL

The last group of books for the teacher consists of practical manuals which are helpful to the teacher in carrying out weather observations in establishing a meteorological station, in checking and setting instruments and in creating a meteorological circle or club. The titles alone of the books quoted below show clearly in what matter they may be helpful.

4. Main Geophysical Observatory. Directing Meteorological Stations of the II Order, first edition, basic meteorological observations, Leningrad, 1926, 131 pp.

The book contains official instructions for stations belonging to meteorological network. Each meteorological station belonging to the network and sending the results of their observations to the weather bureau would be unable to operate without this manual.

5. N. V. Kolobkov. Meteorological Equipment, its Installation and Application, Moscow, 1932, 186 pp.

6. V. N. Kedrolivanskiy. Meteorological Instruments, Moscow, 1937, 321 pp.

The purpose of the last two books is to revise the official manual (4) above.

7. International Atlas of Clouds and States of Sky, Moscow 1940, 43 pp. of text and 73 tables, drawings and photographs of various cloud forms.

Without such an atlas it is quite impossible to carry out effective observations of clouds.

- 10 -

CONFIDENTIAL

CONFIDENTIAL

8. D. Godnev. Propagation of Agro-Meteorological Knowledge in Kolkhozs, Moscow, 1940, 72 pp.

This book advises how to give reports and lectures on problems of agro-meteorology, how to organize agro-meteorological circles and clubs and excursions to meteorological stations, etc. Particular attention is paid to techniques for preparing reports and lectures and producing tangible results and help.

9. D. Godnev and A. Shigolev. Agronometeorological Spot in the Kolkhoz, Moscow, 1940, 136 pp.

This book describes how to observe temperature and humidity of air and soil, precipitations and snow blanket, development and state of agricultural crops in dependence on weather conditions. Much attention is paid to practical observations, forecasting of frosts, determination of water supply in the soil, etc.

10. Central Station of Young Naturalists. Circles of Young Geologists and Phenometeorologists: Program Methodic Material, People's Committee of Education, Moscow, 1941, 126 pp.

One of the chapters of this book presents an example how to study the weather and climate of one's country.

The comparatively long list of recommended books is necessary in order to provide for the reader wide selection and exchange of books. This is essential in view of all the difficulties that one meets now-a-days in choosing the right book.

- E N D -

- 11 -

CONFIDENTIAL

50X1-HUM

C I A

FOREIGN DOCUMENTS DIVISION

27/15 Oct 1951

50X1-HUM

Temperature Variation of Ground Ice

Doklady Akademii Nauk SSSR. Volume LXXV
No 6, pages 815-816. Z. A. Iaroslavskii.
Moscow, 1951. 2 p. 10 cm. 100.

[This report has not been edited
or prepared for publication.]

"Temperature Variation of Ground Iciness"

Inst of Permafrost
Ismail V. A. Obruchev of
Acad Sci USSR

[Note: The following report appeared in the regular Geology section of
Doklady Akademii Nauk SSSR, Volume LXXV, No 6 (21 December 1950), pp 848-6.]

In investigations of freezing processes of soils and grounds (foundations), movement of moisture and winter-time moisture storage, the problem concerning the temperature variation in their iciness assumes great significance. (Note: the term 'iciness' means the ratio of ice to total water contained in the ground, in units of weight.) The data found in the literature characterizing this dependence of iciness on temperature is mainly based upon dilatometric experiments, which in consequence of present deficiencies in this method give exaggerated values of iciness. (Cf 3,7)

In the course of the past two years there have been published material on the determination of ground iciness by the calorimetric method (cf 1,2,5). But the authors in most cases do not give numerical data but limit themselves to graphs. Works have been encountered in which the curves showing the variation of iciness of grounds during freezing not only are not based on factual material but also give completely false representations concerning the freezing processes in grounds of various granulometric composition, as, for example, the graph showing the variation in the quantity of frozen water as a function of temperature (this erroneous graph is in reference 8).

During considerations of the processes of freezing and thawing of soils and grounds one can distinguish the following main category of moisture: firmly bound water; oriented water (that is, loosely bound water or film water); free, capillary-gravitational moisture and vaporous water (cf 4,6). Free water passes over into ice even during insignificant lowering of the temperature. Bound and oriented water and also ground (soil) solutions represent a moisture type that does not freeze for the given temperature conditions when the moisture is in dynamic equilibrium with external influences and actions (cf 6). The quantity of moisture not freezing for a given temperature and the nature of the variation in iciness during fall in temperature are determined by the degree of dispersion and by the mineralogical and chemical composition of the soils and grounds.

In the Central Laboratory of the Institute of Permafrost Science, Academy of Sciences USSR, under the direction of N. A. Tsytovich, a calorimetric method has been developed for determining iciness relative to grounds of natural structure and the basic laws governing the temperature variation of iciness have been established. Table 1 and Figure 1 give data for determining iciness for various temperatures for three grounds that differ sharply according to granulometric composition: quartz sand, blanket (cover) clayey soil (loam) and Jurassic clay.

It is necessary to note that the magnitudes of relative iciness for loam (sand and 25-50% clay) and clay are determined not only by temperature conditions but also by the dampness of the ground, correspondingly decreasing with decrease in the latter. The data of Table 1 and Figure 1 relating to blanket (cover) loam and Jurassic clay in the fluid state represent the maximum values of iciness for given temperature and reflect the general character of the temperature variation in the indicated grounds. When the wetness decreases, the iciness of loam and clay decreases correspondingly and the curves of iciness shift in the direction of the axis of abscissae.

For sand the values of iciness practically do not depend on temperature, and the curve of Figure 1 characterizes the freezing of sand for a wide range of wetness. Thus the data for determining ground iciness during freezing experimentally confirms the theory of the equilibrium state of water in frozen grounds as posed by Tsytovich.

The most important problem in future investigations in this field is the study of the laws governing the variation of ground iciness during thawing.

Submitted
10 Oct 50

- 1 -
CONFIDENTIAL

REFERENCES

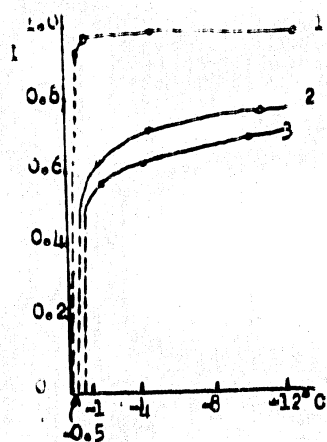
1. P. Verzhinin, Trudy Pis-Agronom Institute, No 4 (1948).
2. P. Verzhinin, B. I. Deryagin and N. Kirilenko, Investiya AN SSSR, Seriya Geofiz i Geog, No 2 (1949).
3. M. Gel'dsheyn, Deformations of Earth Roadbeds and of the Foundations of Structures During Freezing and Thawing, 1948.
4. S. I. Dolgov, Investigating the Movement of Soil Moisture and its Availability for Plants, 1948.
5. N. A. Pisakov, The Planning and Erection of Earth Beds for Railroads and Automobile Roads, 1950, published by the Academy of Sciences USSR Press.
6. N. A. Tsytorich, Investiya AN SSSR, Seriya Geol, No 3 (1947).
7. E. J. R. 28 Pflanzenernahrung, Düngung und Bodenkunde, 24, 1 (1932).
8. Guide for the Execution of Constructional Operations in the Winter Time, 1949, page 9.

TABLE 1. Iciness of Sand, Loam and Clay for Various Temperatures (This data was obtained in the Central Laboratory of the Institute of Permafrost Science with the participation of O. N. Korotkova)

Temperature in °C	Sand. Moisture in % to dry ground $w_{ob} = 11\%$		Loam. Moisture in % to dry ground $w_{ob} = 27\%$		Clay. Moisture in % to dry ground $w_{ob} = 45\%$	
	Relative Iciness	Quantity of unfrozen *	Relative Iciness	Quantity of unfrozen *	Relative Iciness	Quantity of unfrozen *
-0.5 - -0.6	0.92	0.54	0.45	20.0	0.46	40.6
-1.0 - -1.1	0.97	0.30	0.55	17.3	0.53	37.5
-2.0 -	-	-	0.63	14.5	0.58	34.5
-4.5 - -4.6	0.97	0.30	0.71	11.2	0.62	31.7
-10.6 - -10.8	0.97	0.25	0.76	8.7	0.70	22.2

(... clearer numbers see Fig. 1 on Figure 1)

(* quantity of unfrozen water in % of weight of wet ground)



- 1 - sand, $w_{ob} = 11$ to 12%
 2 - loam, $w_{ob} = 27$ to 28%
 3 - clay, $w_{ob} = 45$ to 46%

FIGURE 1. Variation in the Iciness of Grounds in Dependence on Temperature.

- END -

CONFIDENTIAL

50X1-HUM

RESTRICTED

C I A

FOREIGN DOCUMENTS DIVISION

24 Oct 1951

50X1-HUM

Hydrogen Absorption by Metallic Sodium and Calcium

Bulletin Intern. Sc. Math. De L'academie Polonaise, pp 109-128

[This report has not been edited
or prepared for publication]

RESTRICTED

A-2906.1

HYDROGEN ABSORPTION BY METALLIC SODIUM AND CALCIUM

Bulletin Intern. acad. Polonaise 1926 A, pp. 109-28

Dagdan Kamiński

PART I

Introduction

The first experiments of hydrogen absorption with metallic sodium were carried out by Gay-Lussac and Thénard (*Recherches ph. chim.* I. 176 see J. B. fuer Ch. 238, (1874) and later by L. Troost and Hautefeuille (*Ann. Chim. Ph.* (5 S) 2., 273, 1874, C. R. 78, 807, J. B. fuer Ch. 238 1874). The latter two scientists discovered that the process takes place at 300° and they assumed that they were dealing with a chemical reaction which produced an alloy of the composition Na_2H . Several years later Moissan (C. R. 134, 71-75, 1902. *Ann. Chim. Ph.* 397, I. 1902) discovered that the reaction takes place only at 340-430° when hydrogen is passed over sodium, the product of reaction being NaH . According to Troost and Hautefeuille the compound Na_2H was metallic in character, but Moissan declared it to be a salt.

In another publication (Travers-Estreicher, *Experimentelle Unters. von Gasen*, p. 42, 1905) we find that hydrogen might be purified by absorbing hydrogen from metallic sodium at 100-150°, allowing it to escape in the purified condition under decreased pressure. Moutier calculated, (C. R. 79, 124, 1874, J. B. fuer Ch. 112 (1874), by studying the dissociation pressure curve of Na_2H by Troost and Hautefeuille, that the heat developing during the reaction amounted to 13000 cal., but Forcrand (C. R. 140. 990-92 Z.B.I. 1490 (1905), after some experimentation, declared it to be 16600 cal.

Much later than the sodium hydride, Lengyel (*Math. Nat. Ber. Hungary* 14. 180, 1898) developed a calcium hydrogen compound. At the same time Moissan (C. R. 127, 29, 1898) obtained a calcium hydride CaH_2 by direct synthesis from the elements at red heat. Moissan assumed that calcium hydride, (density 1.7) was not an alloy since it did not conduct an electric current.

RESTRICTED

It was natural to use calcium hydride as a light-weight starting material in the manufacture of hydrogen; a method for wholesale production was therefore developed which furnished an 84% preparation (Electr. Werke Bitterfeld A. B. 1907 I. 1283). Georges F. Jaubert (C. R. 142, 788, 1906) succeeded in obtaining a purer 90% hydride using the Bitterfeld method.

Guntz and Basset (C. R. 140, 863, 1905) determined that the heat at which the hydride formed, was 46200 cal. More recently Fr. Ephraim, (Helv. Chim. Acta 4, 76-81, 1921) and Ed. Michel discovered a method of sublimation for CaH_2 and measured its pressure of dissociation.

Dwight C. Bardwell (Journ. Amer. Chem. Soc. 44, 24, 99-2504, 1922) obtained a pure hydride and proved that it is soluble in the eutectic mixture $\text{LiCl} - \text{KCl}$. According to Faraday's law a certain amount of hydrogen is evolved at the anode out of this mixture if an electric current is sent through it. Karl Kaiser (Z. B. 1923, II p.622) obtained an impure CaH_2 from calcium chloride by making hydrogen pass through melted calcium chloride.

Based on the various characteristics, different authors arrived at different conclusions regarding the character of the compounds. Troost and Hautefeuille believed sodium hydride to have an alloy character because they obtained an apparently uniform metallic product of the composition Na_2H with a melting point which was very little different from that of sodium. The dissociation pressure of this hydride varied only within the permissible limits of error from the dissociation pressure of the hydride - of the composition NaH - obtained later by Moissan. This product was not of a metallic character and had a rather high heat of formation (16000 cal.) in contrast to the heat of formation of the alloy of approximately 1400 cal. (Lead 55.6% - bismuth) which only rarely reached 8100 cal. (lead-tin 90%) (Boernst. Land. 3.ed. p.445)

RESTRICTED

Fr. Ephraim, Dwight C. Wardwell, Kaiser, W. Nernst, and K. Moers (W. Nernst and K. Moers, *Z. f. anorg. Ch.* 1920 "The salt character of lithium hydride"). came to the conclusion more recently that hydrides of strongly positive metals have a salt character and that in exceptional cases hydrogen has a negative charge. Other properties of some hydrides however are still undetermined, such as for instance the melting point which is related to the character of the compound, the density, and the atomic volume; neither is there any indication in literature regarding the electric conductivity at melting point temperature and the conductivity-temperature curve which is characteristic for salts. We shall therefore try in this paper to determine the above named properties. As theoretical basis for the determination of the melting point we shall use Lindemann's melting point formula $\nu = 2.06 \times 10^{12} \times \frac{T^3}{av^{2/3}}$

(ν mean characteristic frequency of an atom, T the melting point, a the mean value of the atomic weight, v the mean atomic volume)

Based on this formula and assuming that the characteristic frequency of the hydride is greater than that of the heavy chloride, we came to the conclusion that the melting point of the sodium hydride must lie approximately between 700 and 1000°. Its determination is therefore quite difficult, especially because of the low stability of the compound which is due to a ^{high} dissociation pressure even ~~for~~ relatively low temperatures. Only iron or nickel can be used in higher temperatures (as compared to sodium) as an insensitive and at the same time pressure resistant material. However, since both metals quite readily permit passage of hydrogen, at higher temperatures, the melting point could not be determined.

Calcium hydride is more stable than sodium hydride; that is ~~why~~ why we used it for our experiments. The greater stability is connected to the higher heat of formation which is to be measured especially. This determination was difficult to carry out, due to conditions which we had not previously considered, for instance the determination of the heat of solution of calcium in 0.1 n. hydrochloric acid, which determination is

RESTRICTED

RESTRICTED

is necessary to obtain the heat of formation of the hydride.

An electric furnace consisting of an electric oven which, in turn consists of a quartz container turned upside down. The opening below has the advantage that it can easily be closed with any material which melts easily and can be used ~~at ordinary temperatures~~ ^{hot} at ordinary temperatures. The advantage consists in the fact that the gases will rise and heat the upper part of the "eprouvette" (the container) while the cool gases remain at the bottom. In this manner water cooling of the lower part will be necessary only in the case of a very strong quartz tube.

EXPERIMENTATION

The experimental results obtained by Troost and Hautefeuille, as well as by Travers, do not agree. The object of this particular work has therefore been to carry out experiments which would show whether or not absorption actually takes place at a temperature as low as the one described by Travers. At the start of my work I discovered after only one half hour's passage of the hydrogen over sodium that at 150° there was no noticeable absorption. On the other hand the commercial sodium always contained approximately 8 volumes of hydrogen in spite of the fact that it had not been in contact with hydrogen earlier in the experiment. This agrees well with findings by Lockyer (J. B. Fuer Ch. 1879 p. 163, C. R. 89, 514 (1879)) and Soret (B. (9. 354) Handb. Chem. Kraut Vol. 11, 1906, p. 276). Since hydrogen ~~had been~~ allowed to pass over molten sodium for not more than one half hour, in the earlier tests, we lengthened the time in the subsequent tests. We obtained the necessary hydrogen out of chemically pure sulfuric acid and zinc and lead it for further purification through the following reagents: first through red-glowing platinized asbestos to remove the oxygen, then, for drying, through calcium chloride and through phosphoric anhydride, and finally through molten sodium in order to remove all impurities which react upon sodium. The action took place inside a glass apparatus in which was contained sodium ~~dehydrated~~ purified from hydrogen in a vacuum. The absorption vessel, furnished with a capillary mercury manometer, was immersed into an oil-filled thermostat. Since a noticeable

RESTRICTED

RESTRICTED

absorption velocity was to be obtained we increased the affected surface with the help of a highly active shaking apparatus.

After one half hour at 100 - 110° I obtained a slow absorption with this apparatus as follows: We see ~~xxxxxx~~ from diagram 1 that the ascending hydrogen pressure curve forms a nearly straight line. We had been able to predict this fact since the largest part of the hydrogen was being heated in the absorption vessel and only a part was retained ice-cold in the un-
^{believed we were}
 pillary manometer. We ~~were~~ justified in assuming that ~~the pressure difference would decrease by approxi-~~
^{for every 10° of}
~~the~~ rising temperature the pressure difference would decrease by approxi-
 mately a like amount. However we see that at 100-110° the pressure difference decreases more strongly than we had expected. This proves ~~that~~ absorption ~~is~~
~~is~~ increasing with increasing temperature (table 1). Air could not possibly penetrate into the apparatus, 1) because the entire appara-
 tus was made of glass, 2) there was low-pressure inside the apparatus ~~and~~ the pressure decreased with increasing temperature. After completion of this experiment we pumped ~~out~~ the hydrogen out of the sodium (at approximately 300°) and measured its volume. In this way we regained approximately 1.0 cc³ of hydrogen.

Table 1

Temperature	30°	40°	50°	60°	70°	80°	90°	100°	110°
Hydrogen pressure	472.3	477.3	484.5	485.7	489.7	493.7	498.6	501.1	503.7
Pressure differ. per 10°	-	5.0	4.2	4.2	4.0	4.0	3.9	3.5	2.6
Temperature	120°	130°	140°	150°	160°	170°	180°	-	-
Hydrogen pressure	506.0	507.5	507.5	507.2	506.3	508.0	503.0	-	-
Pressure differ. per 10°	2.3	1.5	0.0	-0.3	-0.9	-0.3	-3.0	-	-

If temperatures are higher, that is to say at 200°, 19.34 cc of hydrogen (0° C, 760 mm Hg) are absorbed from 1 cc Na within 21 hours under 660 mm hydrogen pressure.

RESTRICTED

RESTRICTED

Figure 1 shows the electrically heated oil bath, the hydrogen burette, and the absorption vessel.

It is ~~very~~ difficult, even in a vacuum at 150°, to retain the absorbed hydrogen. It can be removed by vacuum in about 2 hours only at higher temperatures (200°). This fact agrees very well with the dissociation pressure which should have a very low value at 150°. It was impossible to obtain higher temperatures in the oil bath and we therefore constructed an electric resistance furnace. (see figure 2)

An iron crucible contained 0.50 g sodium under 1150 mm hydrogen pressure, maintained during 130 hours at 300° to 350°. During this time the strongly agitated sodium metal absorbed 135 cc of hydrogen, calculated for normal pressure and normal temperature. The velocity of absorption decreased only a little during the course of the experiment; the absorption itself was continued until the resultant product corresponded to the empirical formula $\text{Na}_{1.8}\text{H}$.

It is evident from the formula that in this way it is possible to obtain a higher step in hydration than Troost and Hautefeuille had ~~obtained~~ ~~obtained~~ in their experiments. The sodium which was being used in our experiments was visibly changed; ~~there appeared~~ a white, salt-like crust, approximately 2mm thick, formed on the surface. When brought together with water it exploded releasing a great amount of hydrogen. Below the crust we found close mixture of metallic sodium and sodium hydride, and below this metallic sodium. On repeated melting and thorough mixing the product formed an apparently uniform ~~mix~~ metallic mass of the same melting point as sodium. However, on close examination it was discovered that there were solid particles of sodium hydride mixed in the molten mass.

RESTRICTED

The apparent composition of the material thus obtained is $\text{Na}_{1.8}\text{H}$. The dissociation pressure of Na_2H , as well as NaH (Keyes) does not differ from the dissociation pressure of NaH (Keyes) and NaH (Ephraim) either. This indicates difficulties during experimentation and hence possible errors, but not the existence of different hydrides.

It is evident that passage of hydrogen over sodium at high temperatures will lead to a process of distillation of Na and that, as happened in the experiments by Troost and Hautefeuille, a close mixture of Na and NaH which the above named scientists were unable to separate. On the other hand no such close mixture was evident in above described experiments. The melting point of the mixtures of Troost and Hautefeuille, corresponding to the melting point of sodium, makes it evident that we are probably dealing here also with a mixture containing metallic sodium which would explain the melting point of the sodium hydride. If it were not so we would have to expect a much higher melting point of the sodium hydride NaH than Troost and Hautefeuille have indicated. This is evident from the salt character of the hydrides.

PART II

Manufacture of pure calcium hydride.

The electric resistance furnace used to produce the calcium hydride, consisted of a quartz tube, set upside down. In its upper part an iron crucible contained the calcium. The temperature was measured with a copper-nickel-thermocouple, calibrated by the zinc-aluminum and silver melting points. This thermocouple works very well in temperatures above 400° (Grundlagen, Methoden und Ergebnisse der Temperaturmessung by Dr. F. Henning. 1915 (Fundamentals, methods, and results of temperature measurements") The junction of the thermocouple fitted into a depression on the outside of the bottom of the crucible. Hydrogen was admitted under pressure into this resistance furnace. It was necessary to have an amount in reserve since the velocity of the reaction increased rapidly with increasing temperature (see diagram 4) so much so that at 500° the manometer

RESTRICTED

RESTRICTED

became illegible due to the rapid motion.

As soon as the lively reaction had stopped, the material was kept for 5 hours under a hydrogen pressure of 2 atmospheres at 850-860°, until there was no more change in pressure.

Calorimetric Determinations.

The heat of formation of calcium hydride was determined as the difference between the heat of solution of the calcium hydride in hydrochloric acid and the heat of solution of calcium in the same solvent. We made the calorimetric determinations at the same time as the analysis of the preparation. In this manner we obtained an analysis and a calorimetric determination of the same preparation and thus were able to judge of the purity of the calorimetrically determined products; the amount of hydrogen which developed in the calorimeter was collected in an inverted funnel and afterwards the volume was measured in a gas burette. (I. analysis: 99.2%, Hydride II. analysis: 99.87%)

We used a Dewar vessel in all our calorimetric measurements; ^{the determined} the heat equivalent of the calorimeter and of all parts present in the vessel, ~~I determined~~ experimentally with the help of a certain electrical amount of energy. A Beckmann thermometer was used, to be read with a magnifying glass.

Figure 5 is a sketch of the apparatus. The calcium hydride, weighed inside a glass vessel in a hydrogen atmosphere, is immersed in the Dewar vessel and, after the temperature equivalent has been established, it is opened in such a manner that the piece of hydride is situated underneath the funnel. Certain difficulties were connected with the determination of the heat of the calcium solution. Up to the present the heat of solution of ~~lithium~~ lithium had been determined ~~by introducing into the calorimeter a previously weighed piece of lithium enclosed in a platinum-wire net. This method cannot be used for calcium since the fine wire-net prevents the weak 0.1 n hydrochloric acid from reaching the calcium and because calcium hydroxide forms on the surface of the metal which slows down the~~ by introducing into the calorimeter a previously weighed piece of lithium enclosed in a platinum-wire net. This method cannot be used for calcium since the fine wire-net prevents the weak 0.1 n hydrochloric acid from reaching the calcium and because calcium hydroxide forms on the surface of the metal which slows down the

-8-
RESTRICTED

RESTRICTED

speed of reaction and is the cause of errors. For substances which form hydroxides which are difficult to dissolve, we built the glass apparatus shown in Figure 6. It also serves a mixing apparatus.

I introduced a previously weighed piece of calcium through the opening B into the mixing apparatus, set the apparatus in motion, and immersed it. The length of the transmission string permitted the apparatus to move freely in the direction of the axis. The piece of calcium approached the opening which was closed with a platinum-wire net, but it rarely got very near since the opening lay high enough so that ^{all} the motion of the acid ^{could do as to} pushed the piece/calcium a little farther upward. (Density of the calcium 1.52)

However, as we can see from the following table, the measurements of the heat of the calcium solution in hydrochloric acid do not agree.

Literature with regard to such experiments teaches that the presence of a platinum-wire net is always the cause why individual measurements show considerable variation. According to ~~Thomson~~ Thomson (Thermochem. Unters. Leipzig, Vol 3, p. 246 (Landolt and Boernstein, III ed.) the heat of solution is 108600 ~~wt.~~ cal; according to Ounin and Bassot (C. R. 140, 863, 1905) 129000 cal; Moissan (C. R. 128, 384, 1899) obtained 94100 cal for the heat of solution of calcium in water, and Berthelot (Ann. chim. phy. (5) 4, 1875) obtained 28000 cal. for the heat of neutralization. The ~~xxx~~ heat of the calcium solution is ~~found~~ from the sum of these heats in weak HCl to be 122100 cal.

Use of the apparatus shown in figure 8 does away with all these difficulties [no figures 7 or 8 attached to the original document. "8" possibly a misprint for "3"?]

No.	m	t	W	M	A
1)	0.07938g	0.200°	244.84	234.600 cal	600 cal
				sum: 124.200 cal	
2)	0.1086 g	0.287°	351.35	129.640 cal	600 cal
				sum: 130.240 cal	
3)	0.0369 g	0.083°	100.5	110.330 cal	600 cal
				sum: 110.930 cal	

RESTRICTED

RESTRICTED

No.	m	t	W	M	A
1)	0.1615 g	0.462°	51W.5	126054 cal sum	600 cal 126654 cal 600 cal
2)	0.1985 g	0.606°	623.7	125912 cal sum	126512 cal

No.	m	t	W	M	A
1)	0.03565 g	0.059°	70.095	82750 cal sum	1200 cal 83950 cal 1200 cal
2)	0.0632 g	0.119°	126.4	83250 cal sum	84450 cal

cont. from p.9)

The piece of calcium dissolved smoothly and rapidly; the measurements gave good results.

Both measurements amount to a mean 126583 cal and differ from each other by 0.1%. The results approaches most closely to those of Guntz

and Basset, the difference, however, is 1.9%.

XXXXXXXXXXXX
The third one of the above tables refers to the heat of calcium hydride solution in 0.1 n hydrochloric acid.

XX.

~~XXXXXXXXXXXX~~

The measurements were undertaken at 17°; The heat of formation of the calcium hydride at this temperature was 42383 cal; the experimental error is $\frac{0.6 + 0.1}{2} = 0.35\%$. This corresponds to 296 cal. The heat of formation was therefore determined exactly as 42383 ± 296 cal.

For comparison I am listing below various heats of formation of calcium compounds (Landolt and Boernstein, 3. and 4. ed.)

Ca + 2F	=	CaF ₂	+ 213700 cal
Ca + 2Cl	=	CaCl ₂	+ 169800 cal
Ca + 2I	=	CaI ₂	+ 107250 cal
Ca + H ₂	=	CaH ₂	+ 42383 cal
Ca + (ON) ₂	=	Ca(ON) ₂	+ 11534 cal

It is of interest to note that the energy necessary for the formation of negative ions of the halogens is approximately proportional to the heat of formation of the calcium compounds in question; (Z. f. Electrochem. vol. 26, 1920 p. 493) the heat of formation of Cl⁻ according to various methods is 116000 cal, that of Br⁻ 87000 cal, that of I⁻ 81000 cal, and for negative hydrogen which here appears as a negative ion, 40000 cal.

RESTRICTED

RESTRICTED

The Melting point of Calcium hydride

This determination was done with the help of a nickel-copper thermocouple. This thermocouple can be used to advantage between 400 - 950°. We used a small iron crucible to hold the calcium hydride. The crucible was 2.8 cm high, 1.1 cm. in diameter, and 0.12 cm was the thickness of the sides. The junction of the thermocouple was fitted into a dip in the bottom of the crucible. (fig. 3).

As had been assumed, the mass of the iron crucible delayed the cooling due to the low conductivity to head of the crucible material. For this reason we not only determined the point of solidification of the metals needed for the calibration of the thermocouple, but also the melting point. For the calibration we used zinc, aluminum, and silver. Results are shown in the table below:

	Temperature	Solidification point	M V	melting point
Zn	419.4(1)	378		382
Al	657.5(2)	582		588.5
Ag	959.6(2)	816		858
(1) Day and Sosman	1912	(2) Waldner and Bourges	1910	

Based on this calibration we later determined the melting point of calcium hydride. The table below and diagram 3 show the results.

Solidification Curve				Melting Curve			
1st. measurement		2nd measurement		1st measurement		2nd measurement	
M V	M V	M V	M V	M V	M V	M V	M V
point of solidification		point of solidification		Melting point		Melting point	
725	720	726	718	727	731	727	730
723	719	723		729	732	728	730
722	718	721	721	730	733	731	728.5
722		721		731	734	729	732
722		719		731		729.5	733
Mean: 721.5				Mean: 730.5			

It is evident from the diagram that the melting point of calcium hydride lies between 816.5 - 817° for 870 mm hydrogen pressure. A change

in

RESTRICTED

in pressure of 120 mm does not noticeably alter the melting point. The same melting point could also be determined ~~xxxxxxxxxxxx~~ by measuring the electric conductivity. The iron crucible and a thick iron wire served as electrodes. (diagram 4)

We see from diagram 4 that the melting point lies between 816.6 and 817.8 between these two points conductivity increases 20-fold. The mean of the results from the two methods is 816.15°, lying between 815.3 and 817.°

According to various authors (C. Tubandt, Z. f. Elektrochem. 1920, p. 356; Hittorf, Poggendorfs Ann. 84 (1851) 20, Lehmann, Wied. Ann. 21 (1885) I) there are three different kinds of electrical conductivity of chemical compounds: 1) salts, which before melting with rising temperatures, conduct the electric current better and better, their conductivity increasing especially strongly near the melting point; these salts dissociate electrically ~~xx~~ when melted. Included in this category are sodium chloride, potassium chloride, and similar salts. 2) Compounds which conduct the electric current like metals, as for instance, copper oxide and copper sulfide. 3) Compounds forming ions, conducting like metals, for instance silver iodide. According to this classification calcium hydride conducts the electric current as do the salts of the first class. Calcium hydride therefore has the character of a salt.

The absolute value of the electrical conductivity of calcium hydride, 40° above the melting point, amounts to $1.25 \Omega^{-1} \text{cm}^{-1}$. (Under the same conditions of temperature the conductivity of calcium chloride amounts to approximately $1.16 \Omega^{-1} \text{cm}^{-1}$ (1) This fact can readily be explained as due to the greater mobility of hydrogen in the dissociated ^{state} ~~condition~~ as compared to chlorine. (1. Landolt Boernstein 3. ed. 723; Rec. de Const. phys. Soc. Fr. de Phys. 1913)

PART III

The melting point and the density of calcium hydride is known; with Lindemann's equation (Phys. Zeitschr. 15 Juli 1910) it becomes therefore

RESTRICTED

RESTRICTED

possible to get an insight into the construction of this compound.

The equation is: $\nu = 2.06 \times 10^{12} \times \frac{T}{v^{2/3}}$ (~~xxxxxx~~ ν = mean characteristic frequency of an atom, T = melting point, v = mean value of the atomic weight, v = mean atomic volume).

In the following table we have listed the factors of the equation for calcium and lithium halides ($K = 2.06 \times 10^{12}$, d = density, M = molecular volume). In the table below we find CaH_2 , or LiH respectively, in first place. It is evident from the table that the characteristic frequency of hydrides ^{are} larger than ~~that~~ ^{those} of the halogen compounds, therefore the distances between atoms ^{are} smaller. The characteristic frequencies of the hydrides agree well with those of the halides. The higher the atomic weight of the anion, the greater the distance between atoms.

If we take into consideration that lithium hydride crystallises the same as the lithium halides, that calcium hydride is a good conductor at high temperatures, and that, as we pointed out above, hydrogen acts as anion here, then Ramsay's remark regarding the negative physical character of the hydrogen and its physical resemblance to the halogens appears completely justified, even in individual cases electro chemically. Aston observed the negative hydrogen ions in the "mass spectrograph". It was of interest to note that the positive ions CH_3^+ , CH_2^+ , CH^+ , and C^+ had a greater positive charge the less hydrogen atoms were linked to calcium. At the same time we determined the presence of negative hydrogen ions.

The well-known reaction: $\text{B}_2\text{H}_6 + 6\text{H}_2\text{O} = 2\text{B}(\text{OH})_3 + 3\text{H}_2$ can be explained as follows: $2\text{B}^{+++} + 6\text{H}^+ + 6\text{H}^+ + 6\text{OH}^- = 6\text{H}_2 + 2\text{B}^{+++} + 6(\text{OH})^-$, in this case the hydrogen linked to boron would be negative while the hydrogen linked to water would be, as always, positive.

If we assume that according to the above, sodium hydride has the same salt character as calcium hydride, and that therefore the hydrogen linked to sodium is negatively charged, then we must also assume that its melting point must lie between the melting points of sodium chloride and sodium fluoride.

RESTRICTED

RESTRICTED

These experiments were carried out in the I. Institute for Inorganic Chemistry of the University of Krakau; we wish to express our gratitude to the director of the institute, Professor Dr. Thaddaeus Estreicher.

SUMMARY

It has been determined that sodium, at $100 - 110^\circ$, noticeably absorbs hydrogen whereby NaH originates. The hydrogen absorption takes place slowly. A mixture of sodium hydride and sodium is formed. This mixture only seemingly has the melting point of sodium (Tröost and Hautefeuille); the solid particles of the sodium hydride do not dissolve in sodium.

We obtained pure calcium hydride and the heat of formation of the calcium hydride was determined as the difference between the heat of solution of calcium and that of the calcium hydride in 0.1 n hydrochloric acid/ as being 42363 ± 296 cal. We have also pointed out the various determinations of the heat of solution of calcium in weak hydrochloric acid; we discovered the reason why the values did not agree, and indicated a manner in which it appears possible to determine ^{exactly} the heat of solution of the ~~metals~~ metals which form hard to dissolve hydroxides: according to our method the heat of solution of calcium in 0.1 n hydrochloric acid is 126583 cal. We determined the melting point of calcium hydride with the help of two methods: from the cooling curve and the change in conductivity at the melting point. With the first method we obtained $816.5 - 817.5^\circ$ for $\bar{x}^{an}$ 870 mm hydrogen pressure and, at 120 mm pressure change, a melting point which does not change noticeably. With the other method we obtained $814 - 816.6^\circ$ with similar pressure.

The electric conductivity of the calcium hydride gave a 20-fold change at melting temperature; the conductivity is greater than that of the calcium halides under the same circumstances; the melting point lies between those of chloride and fluoride. By determining the melting point and the electric conductivity we proved the salt character of the hydride. Use of the Lindemann formula for the melting point made an insight into the atom possible. It was discovered that the characteristic frequency

RESTRICTED

of the chemical compound of the series LiH, LiF, LiCl, LiBr, LiI, and CaH_2 , CaF_2 , CaCl_2 , CaBr_2 , CaI_2 ^{de} increased with increasing molecular size, which facts indicate an increase in the distance between atoms.

It seems probable that in some reactions negative hydrogen ions occur; for instance $2\text{B}^{+++} + 6\text{H}^+ + 6\text{H}^+ + 6(\text{OH})^+ = 6\text{H}_2 + 2\text{B}^{+++} + 6(\text{OH})^+$; Anton discovered negative hydrogen ions and positive ions C^{+++} , OH^{+++} , CH_2^{++} , CH_3^+ in his apparatus. In this way Ramsay's assumption with respect to the halogenic character of hydrogen in physical respect has been proved correct by electro chemical methods.

- - - - -

- E N D -

RESTRICTED

RESTRICTED

Table page 12

Temp.	Resist. K	K	$\frac{d}{dT}$	Temp.	Resist. K	K	$\frac{d}{dT}$
947.3	1.165	1.5		820°	1.57	1.12	4.86×10^{-3}
.923	1.22	1.44	2.66×10^{-3}	816.6	1.60	1.1	0.1
917	1.23	1.43		814	29.8	5.9×10^{-2}	
914	1.24	1.42		811	37.3	4.7×10^{-2}	9.4×10^{-3}
900.3	1.27	1.38		809	46.75	3.77×10^{-2}	
890	1.29	1.36		808.5	62.1	2.81×10^{-2}	1.91×10^{-3}
880	1.32	1.33	3.0×10^{-3}	798	105.2	1.67×10^{-2}	
872/4	1.35	1.30		794.2	119	1.48×10^{-2}	2.8×10^{-3}
862	1.38	1.27		786.6	131	1.35×10^{-2}	
850.3	1.43	1.23		765	179	9.86×10^{-2}	
842	1.47	1.20		755	189	8.9×10^{-2}	1.1×10^{-3}
830.5	1.51	1.17	3.65×10^{-3}	731	244	7.2×10^{-2}	
825	1.54	1.14		675	264.9	3.8×10^{-2}	6.1×10^{-5}
824	1.55	1.135		455	5006.	3.16×10^{-4}	1.57×10^{-6}

Table page 13

Table page 13					V	
Salt	d	M	$\frac{d}{dT}$	T		
CaH ₂	1.7	24.75	14.02	8.25	10.89	4.36 x K
CaF ₂	3.18	24.53	26.02	8.14	16.03	3.9 x K
CaCl ₂	2.22	50.00	36.99	16.66	10.53	2.09 x K
CaBr ₂	3.4	58.57	66.64	19.52	10.33	1.28 x K
CaI ₂	4.9	59.98	97.97	19.19	10.13	1.18 x K
LiH	0.816	9.77	11.00	4.88	9.53	9.05 x K
LiF	2.60	10.0	13.0	5.00	12.73	5.79 x K
LiCl	2.068	20.53	21.2	10.26	8.79	4.36 x K
LiBr	3.464	25.09	43.46	12.54	8.20	1.87 x K
LiI	4.063	32.98	66.96	16.49	7.27	1.29 x K

- 16 -
RESTRICTED

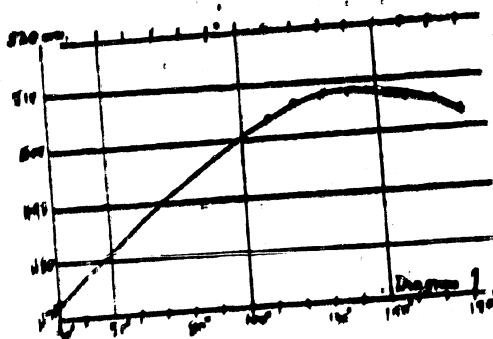


Diagram 1, p. 5



Diagram 2 p. 9



Diagram 3 p. 11

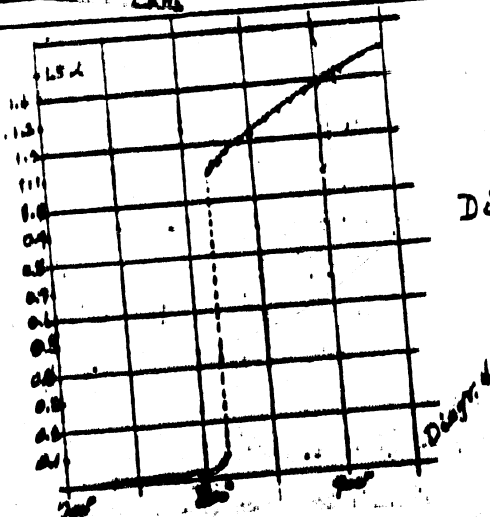


Diagram 4 p. 12

RESTRICTED
Security Information

O I A

FOREIGN DOCUMENTS DIVISION

25 Oct 1951

Table of Contents of the Soviet Periodical
"Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk"

No 1, 1940

IAN, OTN No 1, 1940 —
1941

[This report has not been edited or
prepared for publication]

RESTRICTED

Proj: 10005

TABLE OF CONTENTS OF THE SOVIET PERIODICAL
"IZVESTIYA AKADEMII NAUK SSSR OTDELENIYE TEKHNIICHESKIKH"

NAUK 1940, No. 1

pages

Nikitin, V. P. Academician, "Results of Work of the Department of Technical Sciences in 1939 and Problems of the Present Year"	5-23
Artobolevskiy, I. I. Corresponding Member of the Academy of Sciences "Significance of the problem of the Theory of Machines and Mechanisms in Machine Building Its Contemporary Status and Future Questions"	25-32
Debrevol'skiy, V. V., "Fundamentals of the Theory of Spherical Mechanisms"	33-46
Blokh, Z. Sh., "Synthesis of Four-Link Mechanisms". Institute of Machine Studies Academy of Sciences	47-54
Aronzon, G. S., "Electrodynamic Stresses in Transformers"	55-68
Kravchenko, V. M., "Extraction of Crude Benzene from Compressed Coke oven Gas by Means of Cooling". Experimental Station of Deep Freezing Kharkov	67-84
Nagorskiy, D. V., "Conditionality and Variability of Coefficients of Local Resistance"	85-90
Smirnov, M. A., "Results of the Expanded Meeting on Complex Utilization of Shales During their Combustion"	91-96
Frenkin, I. Z., "Oil Shales - Source for Motor Fuel and Raw Materials for the Chemical Industry"	97-99
Frenkin, I. Z., "Expansion of the Raw Material Base for By-Product Coke Industry"	101-104

	pages
Dolgov, P. M., "Aleksandr Aleksandrovich Ivanov"	105-106
"Chronicle"	107-111
"Publications of the Department of Technical Sciences"	113-119
Izv AN, USSR State Technical Nauk 1940 No 2	
Chudakov, Ye. A., Academician. "Stability of Automobile Axles During Slipping and Skidding of the Wheels"	3-12
Sapozhnikov, L. M., "Study of Coking Coals and Their Deposits"	13-40
Syskov, K. I., "Analytic Expression and Determination of the Strength of lump (kuskovykh) Material". Institute of Mineral Fuels Academy of Sciences USSR	41-46
Makarov, S. Z. and V. F. Greshko., "Method of Investigating the Process of Spontaneous Combustion of Coals and Pyritic Ores"	49-60
Terpigorev, A. M. Academician, A. P. Sudoplatov and V. I. Baranovskiy "Exploitation of Wide Steeply Sloping Beds by Horizontal Layers"	61-70
Talitskikh, V. A., "All Union Conference for Structural Mechanics, Academy of Sciences"	71-91
Lotte, D. S., "Projects of Standards for Basic Letter-Symbols and Letter Symbols in the Field of Electrotechny"	92-94
"Review"	95-98
Belyankin, D. S., "Academician Frantz Yul'yevich Levinson-Lessing"	99-100

Izv AN SSSR Otdel Tekhnich Nauk 1940, No 3	page
Pavlov, M. A. Academician., "Work of the Blast Furnace No 1 of the Magnitogorsk Plant on "New Coke"	3-8
Onizhevskiy, M. P. Academician and F. A. Poputnikov, Engineer "Coke for Metallurgy of the Far East"	9-15
Kravchenko, V. M., "Extraction of Crude Benzene from Compressed Coke oven Gas by Means of Cooling". Experimental Station of Deep Freezing, Kharkov	17-26
Volarovich, M. P., "On the Effect of Pressures Up to 1000 kg/cm ² on Viscosity of High-Viscosity Fluids (Lubricating Oil and others)" Petrographic Section, Institute of Geological Sciences, Academy of Sciences, USSR and IMS	27-34
Markarov, S. Z. and V. F. Orshko., "Investigation of the Heat Evolution of Mineral Coal by the Adiabatic Method". Institute of Mining, Academy of Sciences	35-42
Chentsov, M. A. and M. Ya. Smelyanskiy., "Heat Transfer in Electric Resistance Furnaces and Calculation of Heating Elements"	43-58
Kozlov, V. S., "Calculation of Movement of Water Under Hydraulic Structures in Anisotropic-Permeable Grounds"	59-79
Belyankin, D. S. Corresponding Member and V. V. Iapin "Rocks' in the Glass of the Moscow Glass Factory"	81-88
Zykov, D. D., "Use of Hidden Reserves in Industry"	89-90
Semenenko, N. A., "MEI Recirculating Steam Generator"	91-92
"Results of the All Union Conference on Friction and Wear of Machines"	93-97
"Discussion of the Works of G. V. Shchipanov"	99-117
"Mikhail Aleksandrovich Bonch-Bruyevich"	118-119

Izv AN SSSR Otdel Tekhnich Nauk 1940, No 4	Pages
Shteynberg, S. S. Corr Memb of Academy of Sciences. "Methods of Increasing the Strength of Structural Steel"	3-9
Lavrov, N. V., R. N. Pitin, and L. Farberov "Underground Gasification of Moscow-Basin Coal in a Filtration Channel"	11-18
Kusakov, M. M. and K. Ye. Zinchenko., "Physical Chemistry of Surface Phenomena in Technology of Oil". Laboratory of Petroleum Beds Institute of Mining, Academy of Sciences USSR	19-28
Gerasimov, M. M. and V. Ye. Glushnev., "Cracking of Tars, in which the Light Benzene Fraction has Been Separated from the Gasoline from Shale of the Odovsk Deposit"	29-35
Sokolik, A. S., "Temperature Coefficient of PreFlame Reactions and the Antiknock Properties of Motor Fuel". Institute of Physical Chemistry, Leningrad	37-51
Kamenskiy, G. N., "Relations of Irregular Movement of Ground Water in Finite Differences and Application of them to the Study of Affluent Phenomena"	53-56
Tikhonov, A. I., "Plane Problem Concerning Movement of a Hydrofoil under the Surface of Heavy Liquid of Finite Depth"	57-78
Kanter, A. S., "On Nonstationary Processes in Electrical Machines with Excitation by Permanent Magnets"	79-88
Kostitsyn, V. T., "Concerning an Articulated Control Mechanism"	89-92
Zhuravskiy, A. M., "Of a Method of Approximate Integration of Differential Equations and Computation of Quadratures"	93-107

	pages
Akimov, G. V. Corr Member of Academy of Sciences	
"Bases for Classification, Terminology, and Standardization of Metal Materials"	109-126
Lotte, D. S., "Project of Standard of Conventional Letter Symbols for Computation in Building Construction"	127-130
Sobolev, S. Academician. "Discussion of the Works of G. V. Shechipanov"	131-132
Mitkevich, V. F. Academician, et al. "Aleksandr Alekseyevich Chernyshev"	133-134

Izv AN SSSR Otdel Tekhnich Nauk 1940, No 5

Chizhikov, D. M. Corr Memb of Academy of Sciences

 "Scientific Problems in Nonferrous Metallurgy in the third Five-
 Year Plan" 3-12

Bochvar, A. A. Corr Memb of Academy of Sciences, I. P. Velichko, and

 Yu. A. Velichko., "Influence of Increased Pressure During Crystalliz-
 ation of Copper Alloys on their Quality". Institute of Metallurgy,
 Academy of Sciences, USSR 13-24

Fevzner, B. L., "Study of Refractory Materials in Open-Hearths Furnaces
 during Forcing Operation" 25-42

Gerasimov, M. M., V. Ye. Glushnev, and S. N. Solodov.

 "Zinc Chloride Rectification of the Cracking Distillates of
 Shale Tar 43-48

Kusakov, M., Ye. Prokof'yeva, and Ye. Fayngluz., "Physical Chemistry of Surface Phenomena in Technology of Oil". Laboratory of Petroleum Beds, Institute of Mining, Academy of Sciences USSR	pages 49-58
Shevyakov, L. D. Academician., and K. M. Charkviani, "Determination of the Size of the Mine Pit in Exploitation of Placers". Mining-Geological Institute, Ural Affiliate of Academy of Sciences, USSR	59-61
Terpigarev, A. M. Academician, A. P. Sudoplatov, and V. I. Baranovskiy "Exploitation of Wide Steeply Sloping Coal Strata by Inclined Layers"	63-72
Gorsevanov, H. M. Corr Memb of the Academy of Sciences, "Experiment in Development of Dynamics of Ground Mass"	73-102
Shaumyan, G. A., "'Multi-Machine' Servicing and Automatization of Machines"	103-124
Schenfer, K. I. Academician et al. "Results of the Conferences on Electrothermy and Electric Furnaces"	125-134
Gerasimov, M. M. and V. Ye. Glushner., "Natural Petroleum and Cracking Gases (Krekingazy) of USSR and Methods for their Treatment"	135-136
Izv AN SSSR Otdel Tekhnich Nauk 1940, No 6	3-14
Akimov, G. V. Corr Memb., "Methods of Corrosion Analysis and Research"	15-22
Ivanov, B. V., "Corrosion Phenomena in the Crown Chamotte from the Cupel Furnace of the Chimkent Lead Plant"	23-26
Pevzner, R. L., "Study of Effect of Surface Crust of Chamotte and Dinas Objects on Temporary Compressive Strength"	27-36
Mertsalov, M. I., "Gear Transmission Between Nonintersecting Axes, Executed Along Nonextending Surfaces (poverkhnostyam)"	

	pages
Postyakov, A. N. Corr Memb., "The Great Fergana Canal ineni Stalin"	37-52
Pozlov, V. S., "Determination of the Hydrodynamic Elements for Triple-Channelled Spillway with Asymmetrical Arrangement of the Inner Channel". Institute of Hydrology, Academy of Sciences USSR	53-72
Polubarinova-Kochina, P. Ya., "On Irregular Movement of Ground Water in Two Layers of Different Density". Institute of Mechanics, Academy of Science USSR	73-80
Mel'son-Skornyakov, F. E., "Movement of Ground Water Through a Dam, Drained at the Foundation"	81-84
Aeroskin, A. A., "Hydrostatic Regime of Coking Chambers". Power Engineering Institute, Academy of Sciences, USSR	85-97
Pesterev, P. P., "Results of the Conference on Mine Hoist Cables"	99-103
Talitskikh, N. A., "Conference on Mathematical Theories of elasticity in Tbilisi"	103-106
"Chronicle"	107-111

Izv AN SSSR Otdel Tekhnich Nauk 1940, No 7

Sretenskiy, L. N. Corr MMmb of Academy of Science "Theory of the Hydroplane". Submitted 5 Apr 1940	3-26
Pochvar, A. A. Corr Memb of Academy of Science. "Useful Effect of Crystallization of Alloys under Pressure in Relation to their Composition". Submitted 31 May 1940	27-30
Plokh, Z. Sh., "Application of Connecting Rod Curves in the Solution of Problems of the Synthesis of Plane Mechanisms". Institute of Machine Studies, Academy of Sciences USSR. Submitted 8 Feb 1940	31-38

	pages
Kashirin, A. I. and L. M. Fonin, "Cutting of Metals (preliminary) by the Forced Rotation Cutter System of L. M. Fonin and A. I. Kashirin". Submitted 14 Apr 1940	39-46
Klimenkov, A. M., "Question of Relation of Loss of Pressure in Pipes in the Movement of a Hydromass to the Size of Solid Particles" Hydromechanics Laboratory, Kuybyshev Hydroelectric Power Station (Aldrouzla) Submitted 19 Apr 1940	47-52
Mel'son-Mornyakov, F. P., "Movement of Ground Water Through an Earth Dam with a Central Diaphragm". Submitted 26 Mar 1940	53-64
Pil'mevich, J. V., "Accuracy of Judging Water Flow by Means of Statistical Parameters". Submitted 27 Apr 1940	65-78
Lotte, D. S., "Some principal Questions on the Selection and Construction of Scientific-Technical Terms". Submitted 27 May 1940	79-98
Pevzner, F. L., "Conference on Refractory Materials in Institute of Metallurgy, Academy of Sciences USSR	99-108
Shubnikov, A., "Results of the Conference on Fuel Economy for Railway Transport"	109-116
"Chronicle"	117-122
Izv AN SSSR Otdel Tekhnich Nauk 1940, No 8	
Chudakov, Ye. A., Academician, "Circulation of Power in the Closed System of an Automobile Transmission". Submitted 13 Jul 1940	9-26
Flokh, Z. Sh., "Designing Four Link Mechanisms According to the Limit Value of Acceleration of the Working Link". Institute of Machine Studies, Academy of Sciences USSR. Submitted 28 Nov 1939	27-30

pages

- Rechvar, A. A. Corr Memb of Academy of Sci and I. Kal'berin
 "The Problem of the Role of Intracrystalline Lattice
 Distortion During Hardening". Submitted 31 May 1940 31-33
- Kapelyushnikov, M. A. Corr Memb of Academy of Sci, M. M.
 Gerasimov, and V. Ye. Glushnev, "Modern Methods of Pro-
 cessing Petroleum Gas into High Octane Fuel". Submitted
 25 Jun 1940 35-45
- Perente, L. I., "Question of the Monomolecular Character of the
 Breakdown of Octane and Isooctane Mixtures". Institute
 Mineral Fuels, Academy of Science, USSR, submitted
 11 May 1940 47-50
- Reynold, S. I., "Question of the Behavior of the Coal Bed Covering
 in Underground Gasification". Submitted 7 March 1940 51-65
- Gerdov, M. A., "Some Results of a Thermal Investigation of Rock
 Enclosing Coal Strata for the Purpose of Studying its Behavior
 in the Underground Gasification of Coal". Submitted 17 Apr 1940 67-82
- Lavrov, M. V., "Influence of Oxygen Concentration and Reaction Tempera-
 ture on the Oxidation Rate of Carbon". Institute of Mineral Fuels
 and Lower Engineering Institute, Academy of Science USSR
 Submitted 19 June 1940 83-97
- Makarov, S. Z. and V. F. Oreshko, "Study of the Self-Heating (samorazogre-
 vaniye) Process of Coal by the Adiabatic Method with Varying Rates
 of Oxygen Supply". Submitted 21 Apr 1940 99-112

	pages
Buchnev, V. K., "On New Characteristics of the Intensity of Exploitation of Ore Deposits". Ural Affiliate of Academy of Sciences USSR. Submitted 2 Jul 1940	113-114
"Project of Basic Letter Symbols in the Theory of Mechanisms and General Theories of Machines".	115-118
Kardin, Ye. B., "Great Attention in Educational Literature Automatic and Semiautomatic Devices	119-120
Academician Aleksandr Aleksandrovich Baykov	121-123
"Chronicle"	125-129

Izv AN SSSR Otdel Tekhnich Nauk 1940, No. 9

"Ikitin, V. P. Academician, "On the Dynamic Equilibrium of Systems with a Continuously Varying Load". Submitted 5 Aug 1940	3-10
Ikitin, V. P. Academician and M. P. Funitzkiy, "Stability of the Operation of a DC Shunt Motor". Submitted 5 Aug 1940	11-38
Chudakov, Ye. A. Academician, "Circulation of Power in the Closed System of an Automobile Transmission". Submitted 13 Jul 1940	39-51
Chernyshev, A. A. Academician, "Current Trends in the Development of Electrotechny". Submitted 19 Jul 1940	55-65
Mertsalov, N. I., "Construction of the Consecutive Links Positions in a Three-Dimensional Seven-Link Articulated Mechanism". Submitted 8 Feb 1940	67-78

	pages
Karevnev, N. M., "New Scheme of Periodic Rectification and the Theory of Computation of the process". Submitted 1 Jul 1940	79-98
Perents, L. I., "On the Cracking Rates for Narrow Petroleum Fractions and Their Mixtures (Gaseous)". Submitted 11 May 1940	99-108
Krupennikov, G. A., "On the Distribution of in the Rock of the Outer Layers of the Earth's Crust". Division of Fine Pressure, All Union Scientific Research Coal Institute. Submitted 29 Apr 1940	109-126
Mikitin, V. P. Academician, "Means of Development of the Electrical Welding of Metals". Submitted 21 Aug 1940	127-132
"Yevgeniy Alekseyevich Chudakov"	133-136
Shatelen, M. A. Correspondent of Academy of Science, "Sixty-Year Old Journal 'Electricity'"	137-143

Izv AN SSSR Otdel Technich Nauk 1940, No 10

"Grand Plan for the Construction of the Foundation of Socialistic Society"	9-16
Obrastsov, V. M. Academician, "Fundamental Principles of Construction of the Transportation Network in the USSR". Submitted 15 Aug 1940	17-29
Vinter, A. V. Academician, "Problem of Road Construction Along the Kuybyshev Electric Transmission Lines". Submitted 19 Jul 1940	31-35
Kudryavtsev, A. S., "Reconstruction of the Road Network in the Area Covered by the Kuybyshev Hydroelectric Power Station" Submitted 15 Aug 1940	37-51

	page
Shavl'skiy, F. I., "The Railroad Terminal in Planning of Cities"	53-66
15 Aug 1940	
Nikitin, V. P. Academician, "New Type of Welding Machine with Alternating Current". Submitted 21 Aug 1940	67-70
Nikitin, V. P. Academician and N. P. Kunitzkiy, "Stability of Operation of a DC Shunt Motor". Submitted 5 Aug 1940	71-92
Kulebakin, V. S. Academician and A. V. Khranov, "On Some Problems in Development of Automotives and Telemechanics". Submitted 2 Sep 1940	93-104
Tager, P. G., "New Laboratory of Television Methods"	105-106
Shirokogorov, B., "On the Status of Work on the Problem of Selecting an Electric Traction System for Railroads of the USSR"	107-109
Sergey Samoylovich Shteynberg	113
IZV AN SSSR Otdel Tekhnich Nauk 1941, No. 1	
Nikitin, V. P. Academician, "On the Plan for Scientific Work in the Department of Technical Sciences, Academy of Science USSR for 1941"	3-12
Fritske, E. V. Academician, K. Kh. Tagirov, I. V. Shmanenkov, "Blast Furnace Smelting of Titanomagnetites with Use of Nepheline Syenite in the Furnace Charge". Submitted 17 Oct 1940	13-30
Skochinukiy, A. A. Academician and G. D. Lidin, "Forecasting the Methane Bearing Capacity in the Deep Levels of the Donbas Mines"	31-42
Submitted 20 Aug 1950	

	page
Chudakov, Ye. A. Academician, "Calculation of a Block Brake with Rod Anchor Pins". Submitted 9 Oct 1940	43-56
Lobedev, P. S., "New Method for Determining the Coking Capacity and Burdening of Coal". Submitted 15 Sept 1940	57-79
Bulanin, V. I., "Problem of the Expansion of a Compressed Fluid in a Diagonal Section of a Nozzle". Submitted 5 May 1940	81-105
Moskvitin, A. I., "On Conductivity of the Gap (zazora) with Open Slots in a Stator and Rotor". Submitted 1 Jul 1940	107-117
Mel'son-Skornyakov, F. B., "Movements of Ground Water, with Free Surface to Infinity, thru an Earth Dam with a central Diaphragm in the Presence of a Non-horizontal Impervious Layer". Submitted 31 Aug 1940	119-125
Mel'son-Skornyakov, F. B., "Flow of Ground Water with Free Surface Toward a Drainage System in the Presence of a Deep Impervious Bed" Submitted 31 Aug 1940	126-128
"Publications of the Department of Technical Sciences"	129-136

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 2

Pavlov, M. A. Academician, "Work of Blast Furnace No. 1 of the Magnitogorsk Plant on New Coke in 1940". Submitted 15 Nov 1940	3-7
Britske, E. V. Academician, K. Kh. Tagirov, I. V. Shmanenkov "Blast Furnace Smelting of Titanomagnetites with Application of Nepheline Syenites in the Furnace Charge". Submitted 17 Oct 1940	9-40

	Pages
Terpigorev, A. M. Academician, A. P. Sudeplavov, V. I. Baranovskiy	
"Exploitation of Thick Steeply Sloping Coal Beds with Shafts on the Slope under the Protection of Shield Tracing". Submitted 24 Oct 1940	41-56
Shevvyakov, L. D. Academician, "On Minimum Length of Crosscuts". Mining-Geological Institute, Ural Affiliate, Academy of Sciences USSR, submitted 27 Nov 1940	57-58
Ordina, Yu. V., G. F. Babich, D. S. Grudev, and I. L. Pin'dusovich	
"Study of Berch Arsenic Pails (Kerchenskikh mysht'yakovistykh rel'sov)" Submitted 30 Sep 1940	59-70
Lekerzh-Zenkovich, Ya. I., "On the Nonlinear Oscillations of an Elliptical Cylinder in a Current of Air". Submitted 28 Aug 1940	71-87
Pomerantsev, A. A., "Bending of Pails During Cooling from High Temperatures". Scientific-Research Institute of Physics Moscow State University, submitted 13 Jul 1940	89-115
"Review and Bibliography"	117-119

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 3

Golubev, V. V. Corr Memb of Academy of Science

"Academician Sergey Alekseyevich Chaplygin"

Zhekulin, I., "Propagation of Electromagnetic Signals in Coaxial Cable"

Submitted 21 Oct 1940

11-24

	PAGES
Kanter, A. S., "Effect of the Magnetic Energy of a Rotor on the Demagnetization of Permanent Magnets". Submitted 10 Nov 1940	25-30
Fedorov, V. I., "Deformation of Concrete under Constant Loading" Submitted 12 Oct 1940	31-38
Mel'son-Skorayakov, F. B., "Movement of Ground Water with Free Surface Thru Dam with a Double Diaphragm". Submitted 8 Oct 1940	39-46
Sokerzh-Zen'kovich, Ya. I., "On Nonlinear Oscillations of an Elliptical Cylinder in a Current of Air". Submitted 28 Aug 1940	47-60
Lebedev, F. S., "New Explanation for the process of Coke Formation" Submitted 12 Jul 1940	61-73
Syskov, K. I., "Quality of Blast Furnace Coke and process of its Disintegration". Institute of Mining, Academy of Sciences USSR Laboratory of Chemistry and Coking Coal, submitted 15 Jul 1940	75-90
Belyankin, D. D. Corr Memb of Academy of Sciences and B. V. Ivanov "On Mineral Formation at the Contact of Dinas Brick and Magnesite in Lining of an Open-Hearth Furnace". Submitted 29 Oct 1940	91-99
Kishkin, S. T., "Theory of Tempering Brittleness of Special Steel" Submitted 15 Nov 1940	101-106
Idin, G. D., "On Sorption Capacity of Donbas Coal and Anthracite" Submitted 24 Oct 1940	107-120
Pevzner, E. L. Prof, "Nonferrous Metallurgist's Handbook" Vol I	121-122
"Chronicle"	123-128

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 4

pages

Sapozhnikov, I. M., "Theory of the Formation of Blast Furnace Coke"

Institute of Mineral Fuels, Academy of Sciences USSR, submitted

15 Oct 1940

3-26

Zabavin, V. I., "Solution of Coals in Heavy Solvents as a Method for
Their Characterization and Analysis". Institute of Mineral Fuels

Academy of Sciences USSR, submitted 6 Jan 1941

27-40

Edel'shteyn, N., "Sulphur Compounds in the Tar of Shales from the
Obshchiy Byrt". Institute of Mineral Fuels, Academy of Sciences

submitted 12 Nov 1940

41-44

Gal'pern, G. D., "Comparative Study of Individual Oils of the USSR"

Institute of Mineral Fuels, Academy of Sciences USSR, Laboratory

of Oil Chemistry, submitted 6 Jan 1941

45-54

Sonik, I. P., "Viscosity of Titanous Blast Furnace Slag and Possibility
of Smelting Untreated Kuzinsk Titanomagnetites on Coke".

Submitted 19 Oct 1940

55-66

Kustov, V. F., "Experiment in the Use of Coal Maggot Mixture in a 30-Ton
Open-Hearth Furnace". Submitted 11 Jan 1941

67-76

Iyuban, A. P., "Study of the Blast Furnace Smelting of Ferromanganese"

Submitted 28 Oct 1940

77-90

Vishkin, S. T., "Mechanism of the Effect of Molybdenum and Niobium
on the Tempering Brittleness of Steel". All-Union Institute of Aviation

Materials, submitted 15 Nov 1940

91-94

	page
Kanter, A. S., "Distortion in the Shape of the Magnetic Field in Electrical Machines with Excitation by Permanent Magnets"	
Submitted 3 Dec 1940	95-99
Plakh, Z. Sh., "On the Theory of Conchoidal Mechanisms".	
Submitted 13 Feb 1941	101-106
Dobrovol'skiy, V. V., "On the Movement of the Center of Gravity of an Articulated Four-Link Mechanism". Submitted 13 Feb 1941	107-108
Ternigorev, A. M. Academician and I. I. Voytenko, "Use of Hydro-mechanization in the Mining of Manganese". Submitted 4 Jan 1941	109-112
"Academician Boris Grigor'evich Galerkin"	115-120
"Critique and Bibliography"	121-128

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 5

Zelinskiy, M. D. Academician and G. D. Gal'pern, "Study of Jurassic Oil Deposits of Kos-Chagyl". Institute of Mineral Fuels, Academy of Sciences, Laboratory of Petroleum Chemistry. Submitted 6 Jan 1941	3-10
Chizhevskiy, M. P. Academician and L. M. Tsylev, "Desulfurization of Pig Iron by Means of Calcium Carbide in the Novo-Lipetsk Plant". Submitted 4 Feb 1941	11-14
Agroskin, A. A., "Loss of Coke Gas thru the Lining of Coke-Oven Chambers". Power Engineering Institute, Academy of Sciences USSR Submitted 4 Nov 1940	15-27

	page
Solodov, S. M. and A. M. Tayba, "Regeneration of the Zinc Chloride Carrier During the Refining of Benzene Produced by Cracking at Dubrovaya". Institute of Mineral Fuels, Academy of Sciences USSR Submitted 18 Jan 1941	29-34
Karavayev, N. M. and I. M. Vener, "Quantitative Determination of Indole in Coal Tar". Institute of Mineral Fuels, Academy of Sciences USSR Submitted 5 Feb 1941	34-38
Krasavtsev, N. I., "Interaction of Pig Iron and Slag". Submitted 19 Oct 1940	39-50
Kishkin, S. T., "Nature of the Fibrous Fracture of Special Steel" All-Union Institute of Aviation Materials. Submitted 15 Nov 1940	51-56
Terpigorev, A. M. Academician and M. A. Gerdev, "Toward the Problem of Classification of Rock Enclosing Coal Strata According to their Behavior in a Fire Out During the Underground Gasification of Coal" Submitted 10 Feb 1941	57-64
Romanov, M. I., "Systems of Extinguishing Magnetic Field of Excitation of Synchronous Machine". Submitted 21 Feb 1941	65-84
Evgenson, L. S., "Analysis of Similarity of Heat Conductivity and Hydrodynamic Phenomena by Means of Scale Conversions". Power Engineering Institute, Academy of Sciences USSR, submitted 23 Jan 1941	85-98
Blokh, Z. Sh., "Synthesis of Crank-Gear, Rectilinearly-Guided Mechanisms" Submitted 27 Feb 1941	99-104

	page
Shapiro, G.S., "Problem of the Determination of Stresses in an Elastic Isotropic Massive Near Vertical Cylindrical Development".	105-109
Submitted 18 Dec 1940	
Ptitskin, N. M., "Scientific and Technical Progress and Prospects in the Development of Zinc and Lead Metallurgy"	111-115
Mitkevich, V. F. Academician, Prof P. Ye. Vorobyev, and Prof V. F. Ivanov, "Mikhail Andreyevich Shatelen"	119-122
"Review and Bibliography"	123-129
"Chronicle"	130-136

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 6

Termigorev, A. M. Academician, B. A. Rozentretser, and S. P. Matskevich	
"From Mining Combine to Combined Aggregate in the Solution of the Problem of Complex Mechanization of Coal Production". Institute of Mineral Fuels, Academy of Sciences USSR, submitted 10 March 1941	3-12
Rukavishnikov, V. M. and V. F. Kustov, "Combustion of a Mixture of Sulfite Alkali with Coal Dust". Submitted 21 Dec 1940	13
Lyuban, A. P., "Study of the Smelting of Ferrosilicon in a Blast Furnace"	19-30
Submitted 19 March 1941	
Pevzner, R. L., "Serviceability and Deterioration of forsterite Refractory Materials". Submitted 14 Jan 1941	31-42
Lepin, V. V., "Phase Composition of different Types of Electric Welding Slag". Submitted 19 March 1941	43-48
Blokh, Z. Sh., "Chebyshev Theory of Symmetrical Mechanisms and Their Modifications". Submitted 13 Feb 1941	49

	page
Sher, Ya. B., "Graphic Solution of a Fundamental Problem of Three-Dimensional Mechanics". Submitted 4 Dec 1940	63-71
Lotte, D. S., "Modification of Word Definitions as a Means of Developing Scientific and Technical Terms"	73-90
Shutnikov, A. K., "Scientific and Technical Terminology and its Standardization". Submitted 13 Jan 1941	91-99
Izhvskiy, M. M., "Problem of Devising a System of Letter Symbols for Computation in Different Branches of Technics"	101-105
"Review and Bibliography"	109-112

Izv AN SSSR Otdel Tekhnich Nauk 1941, No. 7-8

Shevyakov, L. D. Academician, "Computation of Stable Dimensions and Deformation of Supporting Pillars"	3-13
Bykov, L. N. and S. I. Komarevskikh, "Problem of Extinguishing Underground Fires in Copper Pyrite Mines": Mining Geological Institute Ural Affiliate Academy of Sciences USSR, Submitted 10 March 1941	15-30
Edel'shteyn, N. G., "On Chemical Composition of Hydrocarbon Fraction in Sapropelic Benzene". Institute of Mineral Fuels Academy of Sciences USSR, submitted 27 Oct 1940	31-40
Gal'pern, G. D., "Comparative Study of Individual Petroleum of the USSR" Institute of Mineral Fuels Academy of Sciences USSR, Laboratory of Petroleum Chemistry, submitted 6 Jan 1941	41-51
Sheynman, A. B., Kh. S. Glavoshkin, V. F. Burmistrova, and O. H. Zhelenina "Temperature Factor in Oil Extraction". Institute of Mineral Fuels Academy of Sciences USSR, submitted 4 Jan 1941	53-62

	pages
Yegorova, O. I., "Study of Petrographic Types of Coal". Institute of Mineral Fuels, Academy of Sciences USSR, Laboratory of Chemistry and Origin of Coal, submitted 27 Dec 1940	63-70
Zabavin, V. I., "Solution of Coals in Heavy Solvents as Method for their Characterization and Analysis". Institute of Mineral Fuels Academy of Sciences USSR, submitted 31 March 1941	71-73
Nikitin, V. P. Academician and M. P. Kunitskiy, "Diagram of Operational Stability of a Direct Current Shunt Motor". Submitted 17 May 1941	75-82
Kanter, A. S., "Magnetic Characteristics of Materials for Permanent Magnets and their Influence on the Operation of Electrical Machines". Submitted 26 March 1941	83-88
Flokh, Z. Sh., "Synthesis of Mechanisms with Stops". Submitted 27 Feb 1941	89-98
Lotte, D. S., "Modification of Word Definitions as a Means of Developing Scientific and Technical Terms". Submitted 16 Apr 1941	99-108
"Review and Bibliography"	109-112

Izv AN SSSR Tekhnich Nauk 1941, No. 9

Popov, V. K., "Means of Developing a Modern Automatic Electric Drive"
Submitted 11 Apr 1941

3-15

Nikitin, V. P. Academician and M. P. Kunitskiy, "Operation Stability of the Leonard System"

17-37

Kuz'min, S. M., "Determination of the Coefficient of Traction Load Irregularities of Electric Railroads". Submitted 12 May 1941

39-48

Shevyskov, L. D. Academician, "Comutation of Stable Dimensions and Deformation of Supporting Pillars". Mining Geological Institute Ural Affiliate Academy of Sciences USSR, submitted 25 March 1941

49-58

page

Senik, I. P., "Viscosity, Fusibility, and Solidification of Titanous
Slags of the System $\text{SiO}_2\text{-TiO}_2\text{-CaO}$ with a Constant Content of $\text{Al}_2\text{O}_3\text{-17\%}$,
and $\text{MgO-8\%}$ " 59-76

Mints, Ts. L. Corr Memb of Academy of Sciences G. V. Akinov
"Effect of Nickel, Manganese, Cobalt, and Chromium on the Structure
and Mechanical Characteristics of an Aluminum Iron Bearing Alloy"
All-Union Institute of Aviation Materials, Laboratory of the Physics
of Metals, submitted 1 April 1961 77-60

Chizhikov, D. M. Corr Memb of Academy of Sciences and N. N. Severyukov
"Continuous Refining of Zinc by Rectification". Submitted 6 May 1961 89-97
"Review and Bibliography" 99-106

- E N D -

- 22 -

50X1-HUM

Security Information

C I A

FOREIGN DOCUMENTS DIVISION

25 Oct 1951

50X1-HUM

Warrant Conferring A Sherifian Decoration

Intestat - No author given - Rabat, Morocco

[This report has not been edited
or prepared for publication]

RESTRICTED

Diligence's medal is Pride and Good Fortune) Poem
 Giving the Individual Light through life)

Thanks to the Only God None Shall Remain But Him

We have bestowed, by the Power of God, upon the friend of our honorable self, Mr Pfeffer Charles, colonel in the American Army, our honorable 'Alawi Medal in the Third Degree because of his deservance of it. May we wear it with much pride and use it as a certificate of the esteem and respect he holds in our honorable self. Written in the Capital City of Rabat, in Rajab 1362.

Should ye need a witness / certificate / at the request of certain people

Be proud in presenting our country's medal

) Poem
)

RESTRICTED

50X1-HUM

RESTRICTED
Security Information

C I A

Oct 1951

50X1-HUM

25th Anniversary Program of the

Polar Explorations Archives

Enclosure to Air Intelligence Informa-
tion Report No ATLO-59-51, Kiel, Germany
June 1951 /probably/

/This report has not been edited
or prepared for publication./

RESTRICTED

RESTRICTED

JUBILEE CONVENTION

of the Association for the Promotion of the Polar Exploration Archives
on occasion of the 25th anniversary of the Archives.

To be held in Kiel, 18 to 20 June 1951.

Monday, 18 June 1951

- 10.00 o'clock Opening session
Opening address^{es} by the director of the Archives, Dr. Grote-
wahl and by the representatives of the Land government of
Schleswig-Holstein and the city of Kiel, followed by a dis-
course by Dr. Grotewahl "The 25th anniversary of the
Archives".
- 11.00 o'clock Lecture by rear admiral (ret.) Eysen, Lustjensee-Bollnaber:
"Voyage of the auxiliary cruiser 'Komet' through the
Siberian maritime route and in the Antarctic, 1940/41".
- 13.00 o'clock Luncheon of the convention participants.
- 15.00 o'clock Lecture by Dr. Holzapfel, Bad Kissingen:
"German polar research, 1940/45".
Followed by lecture of Dr. G. Weiss, Hohen/Loos:
"Wintering and observations on Sabine Island in Northeast
Greenland 1942/43".
Followed by lecture of Dr. Dege, Angermünde:
"The effect of the polar night on winterers".
- 17 o'clock Lecture by Regierungsrat Dr. Flohn, Bad Kissingen:
"Atmos^heric circulation over the polar regions and the
location of the magnetic pole".
Followed by discussion on the day's lectures.
- 20 o'clock Meeting of the convention participants with guests.

Tuesday, 19 June

- 09.30 o'clock Lecture by Dr. Hesse, Leipzig:
"Divergences of mass in the arctic high^h and low pressure
areas".

RESTRICTED

informed by announcements on billboards and in the daily newspapers.

3.) Information on the place of luncheon meetings will be given at the opening of the convention.

4.) Most of the lectures will be accompanied by ~~film~~ moving pictures or slides.

5.) The right to change the program is reserved.

- 3 - RESTRICTED

ST324
UTS

original copy

50X1-HUM

CONFIDENTIAL
Security Information

C I A

FOREIGN DOCUMENTS DIVISION

25 Oct 1951

50X1-HUM

Role of Subterranean Waters in the Formation, Preservation
and Destruction of Oil and Gas Deposits (Ters-Daghestan Oil
and Gas Bearing Oblast)

Doklady Akademii Nauk SSSR, Volume 75, No 5, pages 735-738;
G. M. Sukharev; Moscow; 11 December 1950.

[This report has not been edited
or prepared for publication.]

CONFIDENTIAL

CONFIDENTIAL

HYDROGEOLOGY*

G. M. Sukharev

ROLE OF SUBTERRANEAN WATERS IN THE FORMATION, PRESERVATION AND DESTRUCTION OF OIL AND GAS DEPOSITS (TERS-DAGESTAN OIL AND GAS BEARING OBLAST)

(Submitted by the Academician S. I. Mironov, October 21, 1950)

In the Ters-Dagestan oil and gas bearing oblast, formation of oil and gas deposits took place in several stages or phases.

First stage. Redistribution of oil, gas and sedimentary waters in deposits dating to late paleocenic and Mediterranean epochs occurring horizontally or nearly in horizontal position could only take place under the influence of pressure due to pressure loading of higher strata by tectonic processes, and, finally, under the action of capillary forces.

It can be assumed that migration of gas and oil in first deposits of the late paleocenic epoch took place in the beginning of the middle miocenic epoch or even earlier, since the pressure due to overlying deposits was sufficient to squeeze gas, oil and water from the paleocenic clays into the sand formations of the same deposits. Analogous process in the spirialis deposits and those of the second Mediterranean stage of the middle miocenic epoch began each time to correspond to the formation of new deposits. Vertical migration of gas and oil in the form of emulsion and sedimentary waters took place constantly (decaying gradually).

As a result of the 'outside-of-reservoir' vertical migration of oil and gas, the latter were displaced into porous sandy collectors where they accumulated in the form of separate small spots. Their

* [Note: The report given here appeared in the regular Hydrogeology section of Doklady Akademii Nauk SSSR, Volume 75, No. 5, 1950, pages 735-8.]

CONFIDENTIAL

CONFIDENTIAL

accumulation and the formation of deposits required circumstances which would give rise to layer (lateral) migration. The rise of the lateral (intrareservoir) migration coincides with the time of formation of structural forms, with the gas, oil and sedimentary waters which are within the sand layers beginning to move ~~due to~~^{because of} gravity.

The basic phase of fold formation of tertiary deposits in the Ters-Dagestan Oblast relates to the upper stage of the miocene epoch (early stage of pliocenic epoch fold formation). With the beginning of the upper fold formation, i.e., at the commencement of the early pliocenic phase of fold formation, and with the formation of folds in the sand layers of the late paleocene and Mediterranean deposits, the process of gas and oil displacement began. The gas and oil migrated into the highest portions of anticlinal structures, thus creating gas and oil-gaseous deposits.

The formed oil and gas deposits were located in favorable (from the standpoint of conservation) hydrogeological conditions, since they were surrounded by still waters until the end of the pontiac ^{epoch} ~~century~~. During the early pliocenic period, most likely toward the end of pontiac ^{epoch} ~~century~~, very many structures (anticlinal folds and other forms) were removed by erosion and greatly hollowed out. As a result of this the destruction of oil and gaseous deposits in the given region began. Drainage of oil and sedimentation waters took place with the first appearance of subterranean flow. Denuding processes and the attendant destructive processes involving formed oil and gas deposits had ceased in connection with the prepliocenic transgression and resumed with greater force during the early pliocenic and especially the late pliocenic

CONFIDENTIAL

CONFIDENTIAL

epoch.

Second stage. Starting with the late pliocenic epoch and later, a new orogenic phase evidenced itself within the Ters-Dagestan Oblast. A considerable complication of the previously created tectonic forms takes place during this phase and large longitudinal faults-overthrusts take place in anticlinal zones.

After the formation of numerous disjunctive transgressions, a second stage in formation of oil and gaseous deposits begins. During this late pliocenic time the final formation of flow of the middle miocenic epoch took place; sedimentary waters present in the sands of this complex were gradually supplanted by infiltrated waters, with the surface flow of sedimentary waters in the region of unloading. Movement of the subterranean waters was directed basically from south to north.

Due to the presence of subterranean water flow, distribution of oil deposits formed during that period is of unique nature. Oil and gas in the form of separate microscopic drops passing from clays (matrices) into porous collectors (sands, sandstones, etc.) are overtaken by the moving waters and move with them northward towards regions of loading. However, it should be noted that the tapered off layers within the boundaries of the southern border of the Ters and Sunzhen anticlines are of great practical interest as far as oil bearing capacity is involved, for the lack of subterranean water flow within them, which has a negative effect upon the formation of oil deposits.

An entirely different situation developed in the northern subthrust blocs of the Sunzhen and Ters anticlines. There, in

CONFIDENTIAL

CONFIDENTIAL

connection with the lack (during that period) of subterranean water flow, or, at best, in connection with its negligible flow, more favorable conditions for the formation of oil and gas deposits had been created.

Consequently, in many instances, not only the structural conditions, but the dynamics of subterranean water flow can be used to explain the factual, at times highly capricious distribution of the oil and gas deposits within the boundaries of frontal ridges.

This conclusion means that, in the determination of direction of investigative work, it is necessary, in addition to the study of structural conditions, to study water dynamics, and, depending on this, select subjects for investigation.

The deduction that in the eastern approaches to the Caucasus, formation of oil and gas deposits predicated on the sand stratifications of the "Chokrak" ^{*} -spiralis ~~spiriferous?~~ layers, takes place in two stages, is of very great practical value, since it signifies that oil prospecting can also be conducted within the boundaries of these anticlinal folds, in which, as a result of tectonic and denuding processes, productive possibilities have appeared. In such anticlinal folds, in the presence of longitudinal faults, the wings of the folds, especially the northern ones (considering the above-mentioned hydrogeological conditions), are of interest in probing for oil and gas deposits. In the presence of transverse faults at periclinal extremities, analogous interest is presented by the fault severed periclinal extremities of the anticlinal folds. It should be considered that such disjunctive dislocations not only served as routes of oil migration, thus

**[Note: Populated place in Krymskaya Oblast (Crimea).]*

- 4 -

CONFIDENTIAL

CONFIDENTIAL

forming new deposits of oil and gas, but quite often, under the conditions of the Grozny region, resulted in large surface leakage of oil from the already formed deposits, leading to the depletion and degasification of the basic oil deposits.

The third stage of oil deposit formation begins with the time when oil, and, in some cases, only the free gas of the already formed deposits start to migrate upward along the disjunctive dislocations, saturating porous layers as they move, thus forming gas and oil-gas deposits.

After the formation of oil and gas deposits as a result of continuing tectonic and denuding processes, the exterior anticline arches, especially those elevated convex portions, were subjected to intensive destruction, causing geological formations of various age and lithological composition to appear on the surface in the anticlinal zones. This created favorable conditions for the beginning of subterranean water flow from supply regions toward regions of unloading. Basic streams of subterranean waters are directed from south to north. Waters which flow in this direction over a considerable period of time wash over oil deposits, dragging away oil and gas particles, carrying them to the surface in regions of unloading. If the velocity of flow of the layer waters is great (the latter depends on the difference between the hypsometric markings of like layers in supply and unloading regions, sandstone permeability, and the distance between the unloading regions), the tempo of destruction of the oil deposits increases.

In the case of complicated structure of the anticlines having a boxlike shape with very steep wings, such as the October or Old Grozny anticlines, the sand complexes in the arched parts of such

CONFIDENTIAL

CONFIDENTIAL

anticlinal folds are usually not flushed by flowing waters. In such structures oil was preserved due to the fact that water flows along routes of least resistance at point of anticlinal submerging (along their periclinal extremities). Ancient waters, skirting oil deposits at lower hypsometric markings are gradually diluted by constantly flowing weakly mineralized waters of atmospheric nature. As a result of diffusion and other physico-chemical processes, the strongly mineralized sedimentary waters gradually become fresh. Over the span of long geological periods, equalization of chemical composition of the two types of genetically different waters -- sedimentary and infiltrating -- occurs. In sandstone of low permeability, the flow of subterranean waters is slowed considerably with the resultant slowing up or cessation of the process of destruction of oil deposits, since prior to the exploitation of an oil deposit, the flow of subterranean water about it takes place with very small gradients. Water flows around the oil deposit and has little or no effect upon it. The above is explained by the fact that the velocities and pressures of the subterranean waters are inadequate to overcome the forces of cohesion between the oil molecules and those of geological formations, and cause the latter to move along the sandstone layer, and thus lead to the destruction of the previously formed oil deposit. It must be taken into account that oil has greater viscosity than water.

Sandstones of the middle miocenic-spirialis layers, especially in the bottom sandy-clayish half, vary in phase, their thickness is variable and does not extend over appreciable areas. Many sand layers of these strata have low permeability, and, consequently, unfavorable conditions exist for free flow of subterranean waters in some layers of the middle miocenic sandstones. As a result of lithological

CONFIDENTIAL

CONFIDENTIAL

changes in sandstones of the middle miocenic-spirialis strata, zones lacking water flow emerge at many points.

From the above it follows that no destruction of oil deposits by flowing subterranean waters takes place, and, to the contrary, that in many sand layers favorable hydrogeological conditions are created, which facilitate the prolonged and reliable preservation of the oil deposits. This explains the presence of a large number of oil deposits in the middle miocenic-spirialis strata as compared with the second Mediterranean stage of the middle miocenic epoch.

In water washed sandstones, favorable conditions facilitating the preservation of oil deposits are created by large disjunctive breaks. As a result the flow of subterranean waters in those regions is interrupted, leading to the formation of stagnant zones.

Oil and gas deposits are also destroyed under the influence of subterranean oxidation of hydrocarbons connected with biochemical decomposition of sulfates present in water. As a result of oxidation in the immediate presence of bacteria, hydrocarbons undergo changes including their total destruction.

It should be emphasized that at high temperatures, in excess of 70 degrees, the process of sulfate restoration becomes extremely slow. Consequently, it must be assumed that in those water washed complexes where the water temperature is very high (in some places more than 100 degrees), sulfates will not be restored as a rule. In oil deposits where the temperature does not exceed 60 degrees, water does not usually contain any sulfates. Thus, when studying the subterranean waters of the respective stratigraphical horizons,

CONFIDENTIAL

it is necessary to pay attention to the temperature possibilities of sulfate restoring processes, since only on this basis is it possible to make correct prognoses of the extent of the oil bearing capacity.

Hydrogeological conditions for the preservation of oil and gas deposits are most favorable in the late paleocene and mezozoic deposits as compared with those of the Mediterranean stage. This is due to the fact that the late paleocene and mezozoic deposits take part in the formation of closed structures. In view of the lack of discharge regions for the waters of the late paleocene and mezozoic epochs, favorable zones of no water transfer are created, prolonging preservation of oil and gas deposits.

There is also a lack of subterranean water flow and consequently a lack of water transfer zones in the tertiary and mezozoic deposits north of the forward mountain ranges (valley beyond the River Terek).

Therefore, in many instances, the actual distribution of oil and gas deposits within the boundaries of the forward mountain range can be explained only by the nature of dynamics of subterranean waters.

Grozny Scientific Research Oil
Institute

Received 1 September 1950

References

1. T. M. Gubkin, Transactions of the 17th Session of the International Geological Congress, 4, 1937.
2. N. K. Ignatovich, DAN, 46, No. 5 (1945)

CONFIDENTIAL

CONFIDENTIAL

3. N. K. Ignatevich, Symposium Soviet Geology, No. 6, 1945.
4. N. T. Lindtrop, DAN, 57, No. 9 (1947).
5. A. B. Renov, DAN, 49, No. 3 (1945).
6. V. A. Sulin, Hydrogeology of Oil Deposits, M, 1948.
7. G. M. Sukharev, Geothermal Peculiarities of the Ters-Dagestan Oil-Gas Bearing Province M, 1948.
8. S. F. Fedorov, Jubilee Symposium, in Honor of the 30th Anniversary of the Great October Socialist Revolution, AN USSR, 1947.

E N D

-9-
CONFIDENTIAL

SECRET

Security Information

50X1-HUM

C I A

FOREIGN DOCUMENTS DIVISION

23 October 1951

50X1-HUM

Sells of the Caucasian Lowlands

Podblye Prilnaplyzkeye Rizmennosti, Prof. V. A. Kowin
Moscow, 1950

∠ This report has not been edited
or prepared for publication. ∠

SECRET

SECRET

VII. RECLAMATION OF THE SOILS IN THE PRICASPIAN LOWLAND (P. 234-235)1. State Shelter Belts and Field Shelter Belts

The decision of the Council of Ministers USSR and Turk VKP(b) of 20 October 1948 contemplates the creation of three State shelter belts on the territory of the Pricaspian Lowland during the years 1950-1965:

1. A belt from Saratov to Astrakhan', along both banks of the Volga, 900 kilometers long.
2. A belt from Chirayevsk to Vladimirovka, 500 kilometers long.
3. A belt from Vishnovaya Mountain through Chirayev and Shalikh to Sarayev, 1,000 kilometers long.

The southern part of the first belt mentioned (Privolga State Shelter Belt) will run from the mouth of the Yornulan River to Stalinabad and Vladimirovka, the southern part of the second belt (Pricaspian State Shelter Belt) from the vicinity of the station Kallanovka through Uiten and Dambuchak to Vladimirovka on the Volga.

The Privolga belt will be located along both banks of the Volga with a width of 100 meters. The Pricaspian belt will consist of four belts, each 60 meters wide and spaced 300 meters apart.

In the area around Uden and Bogdo, successful experiments in fixing shifting sands by means of tree planting and colon and grain culture have been carried on for many years.

SECRET

(SOILS OF THE CASPIAN LOWLANDS -- pp. 21-31)

Professor V. A. Kovda

II. CONTEMPORARY TOPOGRAPHY OF THE CASPIAN LOWLAND5. THE BASKUNCHAK PLAIN WITH SANDY MESSAS

A genetically close form of topography is the mesa-like, sandy plain which is situated to the south of the Shungay station, between the western shore of Lake Baskunchak and the fresh-water slough, Lake Kara-Kul'. The region is an area of three broad plain-like ridges of buttes, approximately 100 by 100 by 600 kilometers, which are separated by shallow anticlines and are circumscribed by the contour line of + 30 meters. The separate hills and dunes in the background of the plain, which have a height of + 32, +40 meters, are an indication of that general height of the surface which matches the higher level of the bottom of the Caspian Khvalynsk and, in particular, the surface of the Volga sand ridge (up to 43 meters) and the Syrt Khvalynsk terrace (up to + 45, +48 meters). The region is considerably elevated above the rest of the territory and from the east descends precipitously into the basin of Lake Baskunchak to a level of - 19.6 meters. From the side of Lake Baskunchak the plain is dissected in the modern period by a clearly defined network of ravines. The topography of the territory is plain-like, but it is broken by individual elevations and depressions of up to 30 - 50 meters in diameter. The latter occupy not more than 6 - 10 percent of the territory. The elevated topography of the southern part of the plain is supplemented by the mound-like topography of drifting sands.

Finally, we will note again the cave-like contour in the gypsums in the sections which lie toward the lake. The Baskunchak sandy plain

has a broken, complex contour, which attests to the considerable erosional action that followed its formation. The mesa-like elevations and hills (with geodetic altitudes of + 26, +30 meters), which lie beyond the general contour of the plain, also attest to this, as does the crescent-shaped chain of large sloughs which are formed from the drying-up Lake Kara-Kul', which presses into the plain from the north-west, with geodetic altitudes at the bottom of the sloughs of somewhat below 10 meters.

The general configuration, altitude and topography of the Baskunchak mesa-like plain are such that we may assume that its formation and that of the Volga sand hills were uniform and simultaneous. Considering the latter as the remains of an eroded Khvalynsk delta of the Volga River, we truly consider the Baskunchak mesa-like sandy plain as the huge residual mesa of that same delta, but formed in its submerged part.

The contemporary separation of these genetically related regions is brought about purely by factors of erosion, which follow a post-Khvalynsk regression.

6. LAKE-SLOUGH DEPRESSION (HOLLOW)

We have characterized already a number of the large, elevated features of the topography of the Caspian lowland, which seem to be gigantic eroded and disconnected mesas of one general surface, left by the Caspian and Volga Khvalynsk. Between the Volga hills from the west, the Syrt Khvalynsk terrace from the north, the Torgur-Gorkiy watershed to the east and the mesa-like Baskunchak Plain from the south is included the original depressed plain, which is a huge eroded hollow, filled with fluvio-lacustrine alluvium. The upper parts of this hollow

open into the Torgun River and the mouth of the Yerulan, but the sides ascend smoothly to the Volga hills and the Torgun-Gor'kiy watershed. The hollow is oriented from the northwest to the southeast, toward the well-known Khaka Depression; in this same direction the general slope of the locality occurs. However, the hollow does not open freely into the Khaka as to the central depression of the Caspian Lowland, but is narrowed down by the southern side of the adjacent Torgun-Gor'kiy watershed, the El'ton-Ulagan and Bogdin elevations and several mounds. The hollow is, thus, semi-enclosed in which drainage is difficult. The width of the depression in the northern parts is 50 - 60 kilometers, in the southeast it broadens out to up to 75 kilometers, narrowing again further on near the outlet into the Khaka up to 75 - 60 kilometers. The overall length on the greatest axis of the hollow is 125 - 130 kilometers.

The absolute altitude of the hollow in the northern part, near the boundaries of the Volga hills and the Torgun-Gor'kiy watershed is 30 - 35 meters. But, generally, the northern part of the Ozarnolimnan Depression is sufficiently accurately mapped to the contour line ± 30 meters, which in the form of a broad arc curves along the eastern boundary of the Volga hills toward the Torgun River near the hamlet of Shul'tsa and then toward the Kaysats' stations, and further to the southeast, toward the termination of the Torgun-Gor'kiy watershed. Near the outlet to the Khaka, beyond lakes El'ton and Botkhul', the locality drops down to ± 10 meters; near where the Khaka itself begins the geodetic altitudes equal ± 0 . Thus, the overall slope of the locality along the maximum axis of the hollow equals 30 - 35 meters for 125 kilometers, or 0.24 - 0.28 meters per kilometer. For an estimate of the amount of slope of the bottom of the lake-slough

depression we shall cite the slope of the surface of that hypothetical post-Khvalynsk area which was there until it was eroded away. Taking 50 meters as the higher geodetic altitude of the Syrt Khvalynsk terrace and the geodetic altitude of 10 meters as the height of the post-Khvalynsk plain near Baskunchak, we shall obtain the overall slope for the locality of 10 meters per $1/5 = 200$ kilometers, or $0.050 = 0.057$ meters per kilometer, that is, five times less than for the lake-slough depression (hollow).

From this we may truly draw the conclusion that the lake-slough hollow was formed after the release of the post-Khvalynsk accumulated delta-sea plain, at a lower level of erosion, by means of its great erosion in a southeastern direction. Precisely by means of this erosion is connected the erosional process and the moulding of the Volga sandy hills and the Baskunchak sand-mesa plain. The surface of the lake-slough hollow is exceptionally complex. On it are to be distinguished a number of forms of topography, which are the remains of the erosion of the post-Khvalynsk plain. Such residual areas are around the eroding tectonic elevations of El'ton-Ulagan, which have been touched upon, and the Presnyy Slough, with elevations of 25 - 67 and 25 - 43 meters respectively.

Further, a close form of topography is, again, the remains of erosion which are oriented in a southeasterly and easterly direction, between Lakes Botidul' and El'ton. Such a broad ridge-like mesa is in the region of the hamlet of Karpov (more to the south of El'ton), which rises above the surface of the hollow to a height of 8 - 10 meters, formed by the contour line 20 - 25 meters, and which has a higher geodetic altitude of nearly 28 meters.

More to the south, nearer Lake Kotidul', another ridge-like mesa is distinguished, stretched out from west to east, as well as several mesas of a curved and indefinite form near the same lake.

Still more singular forms of topography, which are characteristic of the lake-slough hollow, are the lakes and sloughs, which diversify extremely the nature of the surfaces of the entire hollow, forming local, non-draining basins, into which waters, salt solutions and sedimentary material flow. The lakes and sloughs, as we shall see below, play a large role in the saltwater rate of the Caspian lowland. Of the four salt lakes in this area, El'ton and Baskunchak were formed in connection with the settling of the individual parts of the saline bosses. These lakes are deeply sunken in comparison with the surrounding territory: El'ton to a level of -15 meters, and Baskunchak to -19.6 meters. The lakes have up to three terraces, which indicates either a recent raising of the banks or, what is more probable, stages of a successive drying up and inundation.

Thus, Lake El'ton has up to three clearly defined terraces. From the water's edge a sloping, saliniferous beach extends for 10 - 20 meters, above which rises up a steep terrace of 1.5 - 2 meters; this terrace has a definite crest and is succeeded by a second terrace, which is rather well-defined (up to 1-1.5 kilometers wide), and has a geodetic altitude of - 0, +0 meters. Then, above the El'ton settlement, by a clearly defined bench, there is registered a third terrace with prevailing geodetic altitudes of nearly +10 meters. This terrace gradually merges into the mesa-like surface, with altitudes of 20 - 25 meters. By means of the 10 - meter third terrace, El'ton is connected by a narrow passage with the Khakas, which are situated in the southeast. At Lake Baskunchak there may be distinguished also

three terraces: the first, from -19.6 meters up to -8, -10 meters; the second, up to 0.0 meters, is rather broad; the third, with geodetic altitudes of nearly +10, is already passing over into the broad plain with mesas up to +20, +25 meters.

It is possible to consider that the process of change in the level and formation of the terraces of lakes Ilt'on and Baskovichuk took place simultaneously and at similar levels. Two other lakes, Botidnui' and Gor'kosolovyy, and also a number of huge sloughs (near the eastern boundary of the Volga hills — the Nospi, Prishib, Noguta, Tashil sloughs, the Sunali Slough, more to the south of the Kaysatskiy and Dzhurylok stations, and others in the region of the village of Zhiltur and to the east of it) are purely residual-erosional formations. Oriented by their greatest axes in an eastern or southeastern direction, the lakes and sloughs frequently are connected by narrow dikes (Prishib and Noguta), or consist of chains of long, twisted links, directed to the side of the saline Khak mud-holes.

The clearest examples of similar linked slough systems are the sloughs extending from the village of Zhiltur to the Sayidin station and which open into the saline mud-holes. In this region there may be distinguished two or three similar systems, divided partly by the mesa-like, elongated heights (mentioned above), but partly by the watersheds between the sloughs which rise to a height of 2 - 1.5 meters above the level of the sloughs.

Sloughs of this type were formed as a result of the repeated action of meandering streams that gradually dried up.

Usually, in all large sloughs, one or two terraces are clearly distinguished, all oriented in the same eastern and southeastern directions, and are built up, as we shall see below, by stratified,

alluvial sedimentations. As examples, we will name Prishib, Moguta, Tazhi and Sunali sloughs.

The Prishib-Moguta group of sloughs and the small sloughs nearly are situated almost in the upper part of the Ozerno-Ikman Depression, near the eastern boundary of the Volga hills.

The sloughs are fed by a huge water-collecting area of nearly 700 square kilometers; from the sides of the Volga hills a number of ravines and gullies descend into it. The sloughs are enclosed by the sandy mounds which stretch to the east, with altitudes of nearly 27 - 29 meters. The bottoms of the sloughs theoretically are flat, with certain parts, principally the center, somewhat deeper, where the slough waters that have collected stand especially long. The overall depth of a slough does not exceed 3 - 3.5 meters. Along the banks of the sloughs, a terrace of sandy ground is detected which rises above them to a height of 1 - 2 meters; the terrace is nearly 200 meters broad, but in some places it thins out. Frequently the shoreline around the sloughs is characterized sharply by the development of a micro-topography.

The Tazhi Slough is situated near the southern end of the Volga sand hills, oriented to the southeast, circumscribed to the contour line 20 meters, and has an area of nearly 50 - 55 square kilometers. The flat bottom of the slough is inclined to the south. The difference in height between the bottom of the slough and the surrounding steppe reaches 6 - 7 meters.

At the southeastern extremity of the Tazhi Slough is a clearly defined folded terrace with stratified alluvium, which is completed by a flat, broad shore embankment. Beyond the embankment on the

steppe side to the southeast is traced a reduction in the width up to 1 kilometer, which is, apparently, the remains of some channel which was washing away the terrace.

The Sunali Slough is situated between the northeastern slopes of the Ulagan hills and the southwestern slopes of the Torgun-Gorkiy watershed, in the northern fork of the Ozernoe-Idman Depression. The slough is enclosed in the depression between the contour lines 25 meters and has the lowest geodetic altitude on the theoretically flat bottom: 19 - 20 - 22 meters. The slough, as usual, extends in a southeast direction. Along the banks of the slough it is possible to distinguish two accumulated terraces and one developed one.

The first accumulated terrace adjoins the bottom of the slough and is noticeably separated from it by the curve of the slope, and it is elevated a little above the slough to a height of 1.5 - 2 meters. Its diameter on the southern side is 1 - 3 kilometers. The hamlet of Morozov is located on the first terrace of the Sunali Slough.

The second terrace is well-separated from the first; it has a width of up to 1 - 1.5 kilometers and an absolute height of 22 - 24 meters.

The microrelief on both terraces is distinctly expressed.

The third terrace, judging by prospecting data, is developed. Its absolute heights are 25 - 26 meters, its width up to 3 kilometers. The microrelief on it from the side of the Ulagan hills is very weakly expressed. All three terraces are traced along the slough in the direction of southeast (toward the Khakas) for a distance of up to 20 kilometers, preserving a distinct expression. However, beyond the limits of Ulagan the third terrace cannot be detected and the

overall height of the locality drops down to below +20 meters.

Much more clearly expressed are the terraces near the saline lakes -- Botkhal' and Gor'kholovyy.

Lake Botkhal' is located near the outlet of the southern branch of the lake slough hollow in the direction of the Khakas, southwest of the Saykita station, in a broad depression. It occupies the lowest part of this depression, an area of nearly 40 square kilometers, and its orientation is to the east. The level of the water in the lake is subject to fluctuation; on the map of the Main Geodetic Bureau for 1928 it is marked with the geodetic altitudes of 0 +0.2 meters. The first terrace above the water is not fully expressed in the form of peninsulas, isthmuses and small, elongated islands. The edge of the terrace descends to the lake by an embankment nearly 4 meters high. The opposite edge of the terrace has a height of nearly 6 meters. The width of the terrace is from 0.5 to 2 - 3 kilometers. The first terrace is dissected by gullies and small streams from the south and west (Solonaya River). The shoreline part of the terrace has a well-defined embankment near the river channel. But the central part of the terrace is somewhat depressed and sometimes contains salt-bearing gullies. The latter are especially well developed on the northern bank of Lake Botkhal'. Sometimes above the general surface of the terrace mesas with geodetic altitudes of +9, +11 meters rise up, the remains of a second terrace. The second terrace is an unbroken belt bordering the first and is connected with it smoothly, but by a clear transition. The predominant surface of the second terrace is included between the contour lines +10 and +12.5 meters. The greatest development of the second terrace is obtained in places where the first is strongly developed. On the

surface of the second terrace there are mesa-like hills with geodetic altitudes of nearly ± 15 , ± 17 .

These heights indicate that the third terrace, with predominating heights of the surface nearly 15 - 17 meters, was broadly developed along the lake but subsequently was eroded considerably, the slope smoothed and changed.

On the northern shore of Lake Botikhul', the third terrace is a narrow (2 - 3 kilometers), long (nearly 20 kilometers) mesa-like height, oriented from west to east with a prevailing height of 12 - 13 meters and separate elevations of a height of 15 - 17 meters. Beyond this height, to the north, is developed a chain of sloughs and gullies, which slope to the southeast from Zhitkura.

In the entire Botikhul' depression, in general, a surface has been developed which has a height of over 20 - 35 meters, regarding which it is possible to judge according to the geodetic altitude of the mesa that is located more to the east of Lake Botikhul' and according to the heights of the Botikhul' - El'ton and Botikhul' - Baskunchak watershed. The small rivers flowing into Lake Botikhul' are highly cut up with breaks in the continuity of the channels, and with sections of slow current and reductions of the flow of water.

The morphology of Lake Botikhul' and its terraces, its location in the deepest part of the lake-slough depression in the system of linking sloughs and mesas, directed toward the southeast, in the lowest region of the Caspian Lowland, permits us to assume that this lake is a deepened part of a stream which is oriented in that same direction -- toward the Khakas. The ridge-like forms of relief and

the small network of parallel channels also permit us to assume that this channel is of the deltoid type. But the presence of two or three clearly defined terraces attest to the two or three successive diminutions and revivals of the erosional-accumulative action of the channel.

Lake Gor'kosoloryy belongs to that same type of residual-erosional lake. It is situated in the central part of the lake-slough depression and occupies the deepest part of the hollow, circumscribed by the contour line $+20$ meters. On the whole, the entire depression in which Lake Gor'kosoloryy is located has an ellipsoidal form and stretches, as does the entire lake-slough hollow, from northwest to southeast, as if it were a link in a chain of sloughs and lakes, going in the direction of Zhikhara, Botkhul', Saykhina and the Khakas.

Lake Gor'kosoloryy is about the same size as Botkhul', and also is characterized by three terraces, the level of which, naturally, is somewhat higher. The lowest portions of the river terrace and island of the lake have geodetic altitudes of $+13.7$ meters. The first terrace above the river, built up by clayey-sandy sedimentations, has an absolute height of $+15$, $+16$, $+17.5$ meters and is characterized by a clear microrelief. The second terrace is united with the general surface of the lake-slough depression.

We saw that the sloughs and the Botkhul' and Gor'kosoloryy salt lakes are genetically similar and resulted as a consequence of the washing away of the Khvalynsk surface and the formation of residual-erosional forms of relief.

It is necessary to refer the numerous ponds to this same type of residual-erosional form. The ponds are similar to the sloughs

but are characterized by smaller areas (up to 10 - 200 hectares), negligible depth in comparison to the surrounding steppe (0.5 - 1.0 meters), and a theoretical flatness. In the spring, the ponds are often flooded with water and become steppe lakes for a short time. The ponds are linked by a complex network, in which, however, it is possible to distinguish their linked, chain-like distribution and connection with the typical sloughs.

A similar picture of the distribution of ponds is observed, for example, in the region of the Dzharybok station, where they were studied in connection with the work of the Dzharybok Station of the Soil Institute of the Academy of Sciences. And here a chain of winding ponds is clearly directed toward the southeast -- toward the Khakau. The large Birsaly Pond covers an area of nearly 40 hectares, and, judging by surveying data, has a small terrace rising up from each side, which gradually becomes a watershed between ponds, slightly elevated above the pond to a height of 1 - 1.5 meters. A similar combination of ponds and watersheds between the ponds for hundreds of kilometers is a typical feature of the landscape of the Caspian Lowland, but in particular of that part which we are considering at the present (the lake-slough depression).

The river, and then the lake-slough, origin of the small chains of such ponds is verified also by the fact that even up to the present winding river beds were sometimes preserved in them. Similar river channels in the system of ponds can be traced in the sloughs and ponds more to the east of the village of Kaysats'. Sometimes these river channels are dammed up by the population in order to collect water. We shall see below that the ponds frequently are built up by layers of alluvium with buried soils that also attest to their origin.

The terraces which are found with the winding chain of ponds usually have a weakly expressed microrrelief, but the watersheds between the ponds are characterized by a sharply expressed microrrelief, which consists of an uneven form of hillocks with a diameter of from 3 - 5 to 10 - 20 meters and similar ponds between them. The difference in height between both elements of the microrrelief reaches 30 - 50 centimeters. The microrrelief with the greatest expression in number of hillocks and variation in heights is attained in the lowest, non-draining parts of the lake-slough depression, for example in the region of the Zhitkur Slough, in the region of the Dzhar'ybek station, northeasterly of the Tashin Slough. The drainage territory near Lakes Baskanchak and Al'ton, on the contrary, are characterized by a weakly developed microrrelief.

For a fully characteristic relief of the lake-slough depression, it is necessary for us to note again the completely original, gigantic, extremely smooth depression, which is located in the "head" of the lake-slough depression, more to the south of the hamlet of Shul'tsa, between the hamlets of Zheloloviy, Ogonniy and the village of Upryamovskiy. The depression is oriented to the south and has an oval form; its greatest length is nearly 15 kilometers, its greatest width 7 - 8 kilometers. The population calls the territory of this depression "rovnyaki". In the middle of the flats are marked several depressed portions with sloughs. The level of the flats is registered with heights of 27.2 - 28.0 meters. Towards the west and east the surface rises to 29 - 30 meters; but here, especially towards the west, there are usually mesa-like elevations with geodetic altitudes of nearly 30 meters. It is possible, that precisely here could begin that stream which eroded the post-Khvalynsk surface, developed the lake-slough depression and provided the beginning of the present-day

salt lakes, and also the sloughs, ponds and the terraces along them (figure 3).

However, the erosion of the post-Khvalynsk plain, it seems, occurred during several periods. Of them, the first was confined to the erosion of the surface up to the level of 25 - 30 meters in the northwestern and 20 - 25 meters in the southeastern part of the depression. The second period of erosion deepened the erosional disintegration of the southern part of the depression and produced in it levels of 10 - 12, 15 - 17 meters for the northern and northwestern part. The movement of the streams which eroded the post-Khvalynsk surface predominated in a southern and southeastern direction from Yaruslan - Torgun toward the present-day Khakas. Apparently, during the second cycle of erosion, the stream was separated into several sections. One of them, deflected by the Ulagan hills, passed through the present-day Sumula Slough, a second through Lake Ger'kosholonyy, Zhitkay Slough and Lake Botldul'.

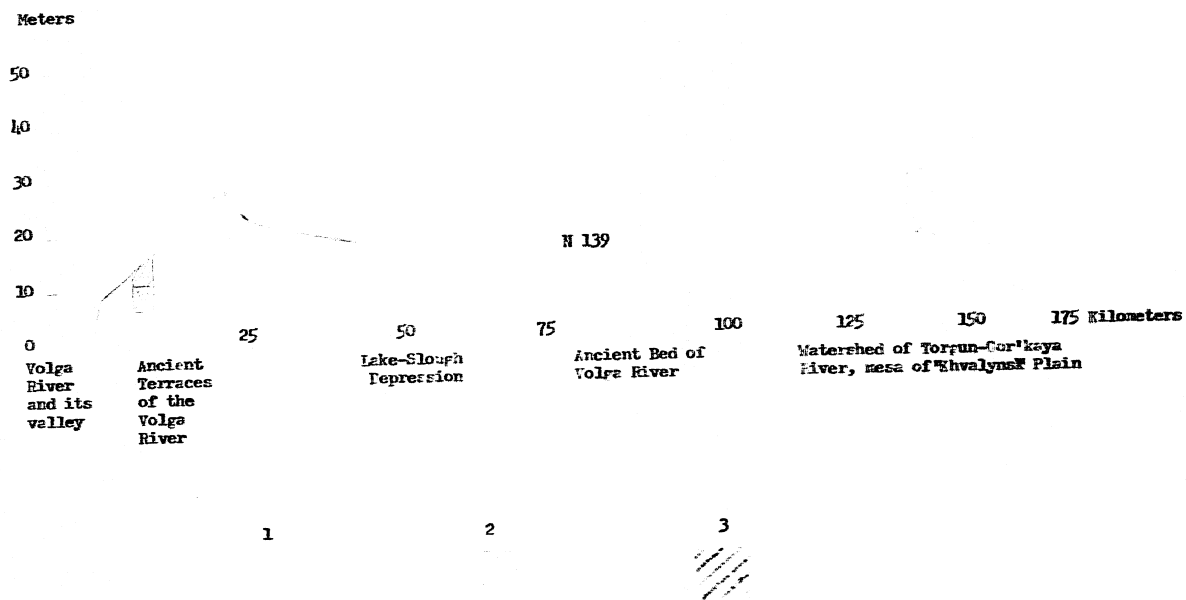


Figure 3. Schematic Profile Through the Volga Hills and Lake-slough Depression
1. Argillaceous Soil; 2. Sand; 3. Brown Chestnut Argillaceous Soil.

The existence of a watershed between Lake Gor'koshovyy and the Tazha slough system, with a contour line of 25 meters and separate heights of up to 23 - 29 meters, permits us to believe that in the second cycle of erosion one branch of the stream flowed toward the south, including in its course the chain of sloughs of Prishib, Moguta and Tazha, and the numerous linked sloughs and ponds between them. It is not excluded, that the breaks in the erosions are to be explained by the transgressional variations and disturbances of the Caspian.

It is still not clear, however, why the Volga sand hills at present do not reach as far as Akhtuba and are eroded more to the south of the village of Vodyanyy, and why the southern and southeastern direction of the lakes, sloughs and heights between them shift in an easterly direction to the south of Milton. To the solution of this question we shall return later.

(SOILS OF THE CASPIAN LOWLAND -- pp. 32-39)

Professor V. A. Kovda

II. CONTEMPORARY TOPOGRAPHY OF THE CASPIAN LOWLAND

6. THE NON-DRAINING ERODED KHAKI HOLLOW (SALINE SILTS)

We have noted that the general incline of the locality of the lake-slough depression is directed to the south-east, toward the huge, non-draining Khaki Depression. The Khaki is a gigantic eroded basin -- the bottom of a powerful stream which was directed also, during the period of its existence, towards the south-east. Today, this hollow represents the final stages of the vanishing of a lake under conditions of a desert climate -- the stages of saline silts, which are periodically, but not continuously, covered with a fine layer of brine. At an average width of 10-15 kilometers, the hollow stretches for 85-90 kilometers to the south-east in the form of an irregular semi-circle, with its prominent side toward the Volga River.

On the north the hollow has a number of coves and ravines opening into it, the bottoms of which are also saline. On existing maps it is possible to see that the Khaki Hollow is located in a chain of similar lake-mud-hole depressions which lie in the direction of the Caspian more or less parallel to the Volga River valley.

The surface of the depression has a geodetic altitude of nearly -5 meters in the north and -10 meters in the south, a rate of slope of nearly 0.05 meters per 1 kilometer.

At first glance the surface of the saline Khaki mud-holes is theoretically flat, but this is not so. The Khaki are hollowed out at present by the small, extremely salty rivers (with a constant current), which are sunken in the bottom of the depression to a depth of 50-70 centimeters. Near the mouth of one of these small rivers (Gor'kaya River) two terraces are distinguished, which are common to the terraces of the depression itself.

The salty water which covers the bottom of the depression stagnates in certain parts of the depression at a distance from the bank, which indicates the elevation of its extremities.

It is possible to note that the part of the depression which is drying up and snow-which from the salt also has an irregular surface with the first exceeding the basic level by 2-3 centimeters. Nearer the banks, this irregularity is increased by the clumps of thick halophytes Halocnemum strobilaceum and Salicornia herbacea, which occupy the raised hillocks.

The western banks of the Khaki Depression are a sharply expressed first terrace, raised up over the Khaki.

The second terrace is also sharply expressed, with places which approach close to the depression and constitute its steep bank.

The absolute level of the second terrace varies from -5, -7 up to ± 0 meters. Above this, from 0 up to ± 10 meters lies the surface which connects the Khaki with the south-eastern end of the lake-slough depression. In general, if one traces the course of the contour lines 0 and ± 10 meters it is possible to see that the zero contour line borders especially the Khaki Depression

and its two terraces. But the contour line +10 embraces in a huge triangle the Khaki Depression, the sand plains down to Lake Baskanchak and the Turgunzul survey mark which are adjacent to it from both sides, the sloughs near the Saykhin station, and Lake Botkhal' down to the hamlet of Aksenov. The apex of this triangle comes up almost to Zhitkur and its base extends toward the south-east at a lower level.

It will be recalled that Lake Botkhal' has a clearly expressed third terrace, with an absolute height of 15-17 meters. One can assume that the third terrace along the Khaki proceeds at a level of 0, +8.0, +10 meters and extends for 30-50 kilometers from each side.

The complete picture suggests a huge deltoid area, the deepened central part of which -- the Khaki Depression -- either developed later, during one of the regressions of the Caspian Sea and the subsidence of the level of erosion, or it was the central, deepest channel of the deltoid area.

Unfortunately, we have no data on the characteristics of the south-western part of the third terrace of the Khaki Depression. According to the data on the map, it is possible to see that here are strewn spots of scattered sands, sometimes existing in the form of layers, but also in the form of sink holes.

An examination of scattered sands of the Bogdinsk forest-development district in 1933 convinced us that the basic form of relief of the sands is ridges which are oriented from north-west to south-east.

The ridges are elevated above the "logi" to a height of 3-4 meters.

It is not clear to us to what degree this sands are typical for all three terraces of Khaki from the south-eastern side.

It is possible to work out a clearer picture regarding the Urdinsk sands, according to location and heights (within limits of -5, -8), which describe also the three terraces of the Khaki Depression.

9. URDINSK HILLS-RIDGES OF SCATTERED SANDS

The Urdinsk hilly-ridges (sandy hillocks) of sand are described in a special study by T. F. Yakubov; therefore, we will pause only briefly on their characteristics.

The sandy massifs of the region are stretched out in the form of long, irregular ridges from north-east to south-west. The ridges are 1-5-8 kilometers wide, interlaced and alternating with flat "logi" -- "ashiki" -- of approximately the same width, partially occupying the non-draining basins, the wastes or sloughs.

The tops of the sandy ridges, as a consequence of weathering, were exposed to disintegration and form sandy hillocks.

Already, Tomashevskiy, referring the Urdinsk sands to the hilly-alluvial type of sands, has considered them as basically alluvial formations and explained their relief (ridges and "ashiki") by the action of currents of water after the sands had been deposited.

Later, V. A. Kovda and N. N. Lobedev (1933, 1934) referred the Urdinsk sands to the ancient-deltoid type. T. F. Yakubov (1935-1937) considers them as ancient-deltoid alluvial sands and subdivided them into sands that have been blown to form hill-like deposits and plain-like sandy steppes -- the "ashiki".

In the central parts of the "ashki" not infrequently are found saliniferous wastes with a microrelief around them of the type described. The question concerning the origin of the Urdinsk sands must be considered in connection with the original, overall morphology of their surface. The combination of sandy ridges, hollows between them and dusty basins within the hollows is characteristic of the deltoid formation. The location of these sands and the Bogdinsk sands close to them on the side along the Khaki Depression, being clearly derived from the action of water, compel us to refer the entire complex of these forms of relief to the conditions of an ancient delta which accumulated at the level -5, -8 meters.

Thus, in addition to the first delta area (Volga ridge and the Baskunchak mesa plain), a second ancient-deltoid area is noted, which was formed in the post-Khvalynsky period, in the period of the erosion of the post-Khvalynsky surface and the alternate, protracted disturbance or regression of the Caspian up to a point parallel to Urda.

10. ANCIENT TERRACES OF THE VOLGA, YERUSLAN, BOL'SHOY AND MALYY UZEN' RIVERS

The Caspian Lowland is characterized by huge river valleys with a system of developed, ancient terraces, heights, morphology and a formation period which are tied up with the erosional phase of the post-Khvalynsky plain.

We shall consider briefly the morphology of the terraces of the Volga, Yeruslan, Torgun, Bol'shoi and Malyy Uzen' as rivers which are characteristic of the described region.

a) Terraces of the Volga, Yeruslan and Torgun Rivers

The Volga River Valley within the boundaries of the north-

western part of the Caspian Lowland, not including the southern part, is sharply asymmetrical, inasmuch as the Volga River Valley is developed only on its left side.

A typical expression and complete development of ancient terraces, basically, is connected also with the left part of the Volga River Valley. The Volga and Yeraslan have a common level of erosion and hence, also, a number of common geomorphological elements; therefore, we shall consider their terraces below at the same time.

The river valley terrace of the Volga and Yeraslan rivers is developed quite distinctly, attaining widths near the mouth of the Yeraslan or along the Akhtaba up to 2-20 kilometers. The absolute geodetic altitudes of the river valley of the Volga near Nikolayovsk and the Yeraslan River delta are measured by geodetic altitudes of ~ 1.5 meters. Below, along the course of the river valley, the geodetic altitudes become negative, and near Vladimirovka are characterized already by an absolute height of -10, -15 meters, with a decline in the surveyed level of the Volga River itself at these same points, accordingly, from -5, -6 down to -20, -22 meters. Thus, on an average, the river valley terrace is slightly raised above the surveyed level of the Volga River to a height of 5-10 meters.

The surface of the valley of the Volga River and the Yeraslan River is extremely complex, with numerous channels, blind inlets ("volozhki"), "staritsy", with diverse islands, crests, hillocks and "logi". The large part of these forms of relief stretch out parallel to the course of the Volga River.

The part of the river valley near the channel is raised

in comparison with the part near the terrace, where the "staritsy" are usually situated, as well as the "volozhki" and channels. It will be important for us to note that the highest absolute geodetic altitudes of the valley of the Volga River are in the latitude of the Khaki Depression, and the bottom of the latter have an almost identical height of -10, -9 meters (the latitude of the villages of Pologoye Zaymishehe and Kapustin Yar). This permits us to assume that the conclusion of the formation of the modern Volga River Valley either occurred simultaneously or the second followed soon after the first.

At the mouth of the Yeruslan River, the river valley of the Volga is united with and then replaced by the contemporary delta of the Yeruslan, with all of the typical indications: numerous lakes, "staritsy", ridges and so forth.

Farther up in the valley of the Yeruslan, the river valley terrace is expressed by separate wedges, first on one side, then on the other side of the river, independently of its meander.

The first terrace above the river valley of the Volga and Yeruslan is represented by distinct remains near the following points: Nikuykovo, Kislovo, Bykovo, Balykley, Solenoye, Rakhinka, Pogromnoye, Leninsk, Tsarevo, Vladimirovka, Rozhdestvenskoye. In the region of the mouth of the Yeruslan River, between the villages of Nikuykovo and Berezhnovka, the first terrace is identical with the ancient delta of the Yeruslan. The absolute height of the terrace reaches +10, +12 meters in the northern part of the region. In the southern part of the region, along the Azhtaba, the level of the first terrace drops down to 4-6 meters. The first terrace is raised up over the river valley terrace by a sharp bluff of 4-5 meters or a steep slope, adjoining the second

terrace on the other side, or, in case the latter has been washed away, the edges of the Volga sand ridge.

The width of the first terrace of the Volga River is not everywhere the same. Its greatest development is below Bykovo, where its diameter is 3-5 kilometers; it reaches a similar width, also, near the village of Vladimirivka. In the other parts of the valley, the first terrace is usually not broader than 0.5-1 kilometer. The plain-like general character of the first terrace is disrupted by the semi-closed and closed depressions, in which sloughs usually are developed. Such sloughs are the Mitin, Deronin, Chisty, Metayev and others. The smallest depressions are combined into sloughs, which supply the present-day "yeriki" and gullies which flow into the river valley. In general, the depressed parts of the first terrace are found close to the starting point of the second terrace. In the most recent period, the first terrace was exposed to a rather strong disintegration by the similar "yeriki" and gullies. Certain parts of it, situated along the boundaries of the river valley, are raised up a little and have the characteristic of ancient, sandy ridges near the river channel. The surface of these ridges was exposed to weathering and are characterized by a sandy hillock relief. Such sands are found below the village of Bykovo, near the village of Proloyka. In other parts, similar ridge-like elevations are absent, but some elevations are detected. The microrelief on the surface of the first terrace is extremely weakly developed. The territory of the first terrace between the villages of Potemkino, Berezhnovka and Nikuykovo, strictly speaking, is already an ancient delta of the Yeruslan that was formed on the same level

of accumulation as the first terrace. The natural boundary of this delta within the limits of our region is near the villages of Berezhnevka and Melchenyevka in the river valley of the Yeruslan and Volga. To the south and south-east the ancient delta of the Yeruslan is cut into the Volga sand hills in the form of a gigantic semi-circle, isolating from it a chain of lakes (K ozukovatoye, Talovatoye etc.), sloughs, and depressions.

The dimensions of the delta are determined by the diameters 10 x 15 kilometers. The absolute heights of the ancient delta of the Yeruslan vary within the limits of 12-17 meters. The surface of the delta is described as undulating, because of the numerous crests, ridges and the hollows between them, which extend in a southwestern direction toward the Volga. In many hollows there are lakes (Chmorevo) and sloughs. Part of them (the deepest), adjoining the Volga ridge, are made use of by the two present-day rivers -- the Nonta and the Kara. In the north-eastern part of the delta, mesas of the Volga ridge, with geodetic altitudes of 17.5-20.0 meters have been preserved.

Present-day erosional action is expressed in the ancient delta of the Yeruslan extremely sharply and appears in the numerous gullies, which rise from the river valley and are enclosed in the hollows between the ridges. Part of the gullies attain very considerable sizes and, together with their branches, embrace a large territory (for example, the gully north-west of Lake Chmorevo).

The second terrace above the river valley terrace of the Volga and Yeruslan rivers, in contrast to the first river valley terrace, is a broad, monotonous, plain-like surface with a sharply expressed transition on the side of the first terrace and the

side of the Volga sand ridge. The second terrace can be traced for the entire length of the Volga and Yeruslan river valley, and is adjacent to part of the latter's tributary, the Tongun River.

The most distinct development of the second terrace is produced along the Volga River, between the villages of Nikuykovo and Nikolayevskiy, and farther on in the region of the villages of Kislovo, Solyanka, Verkhnyy Balykley. The second terrace is broadly developed between Balykley and Bakhinovka and farther on from the village of Zaplavnyy along the Akhtuba to the villages of Vladimirovka and Kozhdestvenskiy. At points in the northern part (near Nikolayevskiy), the second terrace attains a width of 4-5 kilometers. Along the Akhtuba the second terrace broadens out up to 20-15 kilometers.

The absolute heights of the second terrace in the region of the village of Nikuykovo equals 18-20 meters, near the village of Nikol'skiy they drop down to 15-16 meters, and near the villages of Zaplavnyy, Kapustin Yar, and Vladimirovka to 15-12-10 meters. The plain-like surface of the second terrace is concave along the inner part at its boundary with the Volga ridge, and contains in these parts closed depressions, large hollows or sloughs, as, for example, the Lebyazh'ye slough-lake near the village of Levchunovka or the slough which is more to the north of the village of Zaplavnyy. Present-day erosion causes intensive disintegration of the second terrace, with sharply expressed gullies. Such gullies are the Shirokiy Yerik, Siven'kiy Yerik, Bondarenko, Samburovka, Zaytsevo, Karakchevo, which flow into the Yeruslan River, and the Nikolayevskiy Yerik, Kislovskiy Ravino,

Solyanka, Yablonevyy Gully, Mordovskiy Gully, Peschanaya Ravine, and the Sakharov, Kolobovka and Kapustin Yar gullies, which flow into the Volga River.

The microrelief on the second terrace is very weakly expressed, with the exception of the parts near the sloughs, where frequently there are encountered deep cracks and polygonal overhangings of mounds with diameters of 1-2 meters.

The second terrace is traced not only along the Volga River, but also along its tributaries -- the Yeruslan and Torgun. Beginning with the comparatively narrow strip near the hamlet of Chaykino (3-3.5 kilometers), the second terrace extends upward along the course of the Yeruslan River, gradually broadening out. Near the mouth of the Torgun River it is 8 kilometers wide, again narrowing beyond the Kazach' dam down to 3-4 kilometers and extending along the Torgun River farther beyond Pallasovka.

The absolute heights of the second terrace in this part are characterized by geodetic altitudes of 18-21 meters, but in contrast to the second terrace of the Volga, there are here many mesa-like elevations with geodetic altitudes of 22-23 meters, which attest to the earlier eroded level. If the second terrace of the Volga is purely accumulative, then the second terrace of the Yeruslan -- Torgun bears traces of a developed terrace, or, more correctly, of an accumulative terrace, but affected by the subsequent intensive erosion.

A rather dense network of ravines with wide valleys and turf-covered slopes intersect the terrace, discharging into the Yeruslan and Torgun.

Undoubtedly, this secondary erosional action caused the disintegration of the second terrace of the Yeruslan-Torgun by

means of ravines and "yeriki" (Siven'kiy, Shirokiy, Sukhaya Talovka, Morkaya Talovka, Solyanka River and others) on the flat watersheds with long, slanting slopes. In the lower course of the ravines, gullies are developed which are the result of recent erosional disintegration. All this will create the second terrace of the Yerusan and Torgun in this noticeably dissected part, especially in the riparian strip, and stipulates a considerable natural drainage of it. However, here also are encountered ravines and single sloughs. The microrrelief here, as also on the second terrace of the Volga River, is weakly expressed, or is not completely expressed.

The third terrace of the Volga River. Besides the two ancient terraces along the valley of the Volga River, there is a third terrace, the expression of which, however, is weakened and levelled down in view of its considerable age and erosion. The third terrace represents the border along the Volga ridge, up to 3-5 kilometers wide (near the village of Vodyanny up to 10 kilometers), with absolute heights of 25-30 meters near the northern border of the region and 20-25 meters along the Akhtuba River.

More to the south of the boundaries of the Volga ridge the third terrace broadens out and becomes a broad plain-like surface, situated in the form of a broken strip along the Akhtuba River, parallel to the second terrace.

It will be remembered that in the analysis of the relief in the interior part of the Caspian Lowland, the surface 25-30 meters and 20-25 meters above sea level is extensively represented

by mesas and mounds (lake-slough hollow, depression) or even by great massifs (drainage plain near the Uzen'). The third terrace is characterized by a plain-like relief and a slight incline toward the Volga River. Along the Akhtaba, the third terrace has the character of a weakly expressed watershed between the Akhtaba and the lake-slough depression. Here it is bounded by the contour line 20 meters and marked by separate mesas -- mounds (Golyy Kurgan).

The microrelief on the third terrace is weakly expressed, but in the part near the Akhtaba it receives a certain development according to the degree of discharge from the river.

SECRET

(SOILS OF THE CASPIAN LOWLANDS -- p. 42)

Professor V. A. Kovda

III. SOIL-FORMING SURFACE ALLUVIUMS

Above, we hoped to show how complex the topography of the Caspian Lowland is and how erroneous is the impression concerning its "uniformity" and "monotony".

To a similar degree, the alluviums composing the surface of the Caspian Lowland are different. Here are encountered, with the surface alluviums, a type of scattered sands, sandy loams, dusty, loess-like, heavy argillaceous soils, and, finally, heavy chocolate loams.

Having accumulated in conditions of the shore zone of the Khvalynsky and post-Khvalynsky basins, in deltas, on the terraces of rivers, and on the bottoms of lakes, the surface alluviums of the Caspian Lowland, in the majority of cases, are stratified, although the stratification is sometimes highly disguised by the subsequent processes following sedimentation of erosion and soil-formation, and, particularly, by the formation of gypsiferous and carbonaceous levels.

It is interesting to note that in addition to the usual stratification, in the alluviums of the Caspian Lowland buried soil or bog layers are widely encountered, indicating that purely superficial conditions more than once interrupted the "subakval'nyy" conditions of the accumulation of alluviums. Such buried soil layers are encountered both in the river terraces and also in

the plains proper of the Caspian Lowland, and even in the Syrt border zone.

The next characteristic of the alluviums which compose the top layer of the Caspian Lowland is the general loess-like appearance, which is acquired by them during the course of their existence on the surface. Only the Urdinsk sands and the young alluviums of the river valleys do not have these features. But even the sandy and sandy loam sedimentations of the Volga ridge have characteristic pale yellow tints, porosity, carbonaceousness and vertical cleavage in structure.

(SOILS OF THE CASPIAN LOWLANDS -- pp. 230-40, 241-50)

Professor V. A. Kovda

VII. UTILIZATION OF THE SOILS OF THE CASPIAN LOWLAND

2. EXTENSIVE IRRIGATION OF THE CASPIAN LOWLAND

A detailed analysis of the general physical-geographical situation and particularly of the soil covering of the Caspian Lowland permits the assumption that for an extensive irrigation of soils by Volga River waters, extremely favorable areas exist, which do not demand large expenditures for the realization of preliminary developments. Some areas can be irrigated successfully by relatively small meliorative measures. Finally, there are regions which demand substantial meliorative work, and regions, also, unsuitable to contemporary engineering.

In the following account, we divide the part of the Caspian Lowland studied by us into regions, guided by the presence or absence

SECRET

in the given territories of the necessity for such meliorative measures as the chemical enriching of solonetz soils, drainage, washing, substantial levelling of the surface. In all, we distinguish five groups of development areas and sub-areas:

(1) not requiring any continuous meliorative measures, excepting the improvement of single, isolated spots of solonetz;

(2) not requiring any continuous meliorative measures, but requiring the improvement of separate portions of the solonetz blocks, and impressing apprehension of the formation, after the beginning of spontaneous irrigation, of high ground waters;

(3) requiring extensive improvement of the solonetz complexes, levelling, washing out of salts from the saliniferous solonetz soils, and the conducting of single collectors;

(4) requiring, in spontaneous irrigation, drainage at deep spots of not less than 2.5 meters, great washing, improvement of solonetz, substantial levelling of the microrrelief;

(5) as yet not suitable for irrigation.

The first group of improved regions (No. 4, 5, 10, on the map of the regions -- figure 1) includes the greatest drainage and saltwater distillation territory with deep (deeper than 15-17 meters) and weakly mineralized ground waters and light-chestnut soils of simple mechanical composition (sandy, sandy loams, aronaceous -- light argillaceous) which are completely non-saline or very weakly saline. In this group are found: the Volga ridge, Baskunchak mesa

plain, and the third ancient terrace of the Volga River.

In conducting an irrigation network it is necessary to struggle with the increased permeability of the sandy soils and the loss of waters.

Separate spots of solonchaks on the lower parts of the slopes, and also on the depressed second terrace of the Volga River, demand a selection of gypsum treatment (from the estimate of 2-3 tons per hectare of gypsum) of a deeper and more intensive friability.

Rings of solonchak complexes around the sloughs and the sloughs themselves it is expedient to cut off from the zone of regular irrigation. In order to be free of elementary meteorological conditions during the course of the year it is expedient to make sure of the control and re-distribution of the waters of the surface discharge of sloughs to the desired areas by the removal of the phenomenon of swamping in the central parts of the deepest sloughs.

The overall area of the regions of the first group is 700 thousand hectares.

Indisputable, the high developmental properties of the areas of the first group permit the advancing of the boundaries of extensive irrigation in the Trans-Volga and Caspian Lowland along the Volga River, on a line generally coinciding with the valley of the Volga from the hamlet of Shul'ts to Aleksandrovka, the western banks of the Tashla Slough along the Volga and from there to the

Alhtuba and along the latter to the Shungay station on the Ryazano-Ural'skiy Railway.

The third group of meliorative regions (No. 11 on the map) unites the complex soil covers of the second ancient terraces of the Volga, Yeruslan, Torgan, Bol'shoy and Malyy Uzen' rivers and those parts of the lake-slough depression and Uzen' Plain which are drained by them.

The ground waters of the regions of this meliorative group are very variegated and strongly mineralized; they lie at a depth of 7-9 meters, flowing slowly to the side of the channel of the corresponding river. At the edges of the second terrace of the Volga River, the ground waters drop down to 15-17 meters.

The soil cover is represented by complexes of residual-saliniferous, acicular solonets and dark-colored meadow soils, and also the meadow soils of the large gullies.

Particularly, we refer to this category also the region of weakly "osolodelyy" dark-colored soils of the Upryamovsk Flats. From that group we exclude the complexes of soils of the second terrace of the Volga River, developed to chocolate loams, adding them to the fourth meliorative group. The irrigation of the regions of the third group requires already the application of meliorative measures in relation to the solonetz soils, which make up a considerable percentage of the complexes. In those cases in which the residual-saliniferous solonetz soils have only a small content of gypsum under the solonetz layer (up to 30-45 centimeters), which

must be established each time by field and laboratory analyses, for the melioration of these solonetz spots it is possible to employ fall planting on the low spots, including the gypsum layers, with possibly a more complete turnover and admixing of the layers. After planting, it is necessary to expose the meliorative portions to irrigation (in the fall and winter, but before freezing, when the soil is not frozen).

In those cases when the soil-gypsum layers occur deep down in the solonetz and it is impossible to utilize them for "self-melioration", it is necessary to introduce gypsum from outside.

The technique of melioration of the solonetz in this case is that recommended as follows. In the fall, the ploughing of the soil causes the solonetz layer to be turned up onto the surface. Into the spots of solonetz, gypsum is introduced from the surface in amounts of 5-8 tons per hectare. After this, a careful inter-mixing of soils of the gypsum portions is carried out by means of a cultivator or harrow. Then, without fail, the meliorative territory is moistened by 2000-2500 cubic meters of water per hectare. In the spring the meliorative field is re-ploughed. According to the data on the melioration of solonetz of the USSR, it is desirable to introduce manure or nitrogen fertilizers.

As shown by the investigations of the Soil Institute station in the village of Alekashkin, it is possible to mix gypsum and ash in equal proportions, which, when the soils are moistened, is very beneficial and permits the reduction of the

amount of gypsum consumed.

Care in working soils during planting and during the introduction of gypsum into them, and, especially, care in mixing the soils with gypsum or with the gypsum layer, are the main conditions for success in chemical mollification.

It is extremely probable that after 1-2 years of utilization it will be necessary in certain places to put gypsum into additional areas, and this ought to be done.

The mollification of solonetz will proceed more successfully when rotation of crops of the grass-alfalfa type are introduced. It is better if the developed fields pass through the solid-grass stage of crop rotation beforehand.

The solonetz spots on the second terraces of the rivers alternated with non-saline, dark-colored meadow soils. In individual cases the latter occupy large areas -- gullies or groups of gullies (Upryamovsk Flats).

These sections will be better for irrigation. Usually, for the irrigation of small section on local run-off, kolkhoses select precisely such areas, in which non-saline meadow soils predominate or which are continuously represented by them. To the number of better areas of the suitable type belongs the Upryamovsk Flats, which is drained by the Torgun River, and also the areas of the second terrace of the Volga River where chocolate loam is absent.

SECRET

In spite of its well-known drainage capacity, in the spontaneous irrigation of the soils of the regions of the third group (that is, the second terrace of the rivers), with very large areas, it is necessary to provide, in separate cases, for the construction of large collectors, which utilize the natural depression, slopes and dissection of the territory.

On the second terraces of the river in the Trans-Volga there is a rather large experiment of kolkhos irrigation, studied by the author (1937) and Professor H. I. Usev (1940). We note that on the whole this experiment is sufficiently favorable, if the irrigation is not accompanied by strong heating of the irrigated territory of the second terrace from the side of the reservoir.

The fourth group of meliorative regions (No. 6, 2, 7 on the map of the regions) embraces that area of the Caspian Lowland which is characterized by very weak local drainage capacity, high-salinity of soils, high mineralization and great variation of the ground waters near the surface (3-7 meters), and also by a sharply complex soil covering of meadow soils (sloughs, gullies and hollows) and strongly saliniferous, suberized solonetz soils, linked with the ground waters and still occurring in the stage of near-solonetz salinity.

To this category we refer the lake-slough depression, the watersheds of the Torgun-Gor'kaya rivers, the Uzen' Plain and the second terrace of the Volga, Yeruslan and Torgun rivers, the port, that is, built up by chocolate loams.

SECRET

Spontaneous irrigation of this area requires a great deal of effort toward the improvement of the solonchaks and the drainage. Here, together with the improvement of solonchaks (which in full measure can be carried out by the method of planting to 30-40 centimeters), is required the construction of a drainage-collector network. We have pointed out above that the salting of the ground and soils up to the surface ceases in the conditions of the Caspian Lowland at a depth of ground waters below 175-200 centimeters, which it is necessary to assume as the critical depth for the occurrence of ground waters in the Caspian Lowland. Therefore, in order to create even 50-75 centimeters of non-saline soil for the development of the root-system plant, the ground waters in the named regions should be held, as a minimum, at 250-275 centimeters. Thus, the laying of drains to a depth of 250-275 centimeters is required, utilizing collectors at 300-325 centimeters or deeper.

Is the laying of drains in these central parts of the Caspian Lowland necessary in spontaneous irrigation? This question can not give rise to two opinions. In the presence of the salting of the ground and soils of the fourth group, irrigation is required for their utilization. The promotion of irrigation systems without drainage in a territory where the processes of salting still have not ceased and where there is no natural run-off of the ground waters, entails a rapid rising of ground waters and the development of an intensive secondary salting. Comparing the regions of the fourth group, we can all put the watershed of the Torgun-Gorkaya in first place, in second

place, the Uzen' drained plain, and in the third place, the lake-slough depression, especially in its southeastern parts, and the second terraces of the Volga River, the Yeruclan and the Torgun, in the parts built up by chocolate loams.

During similar amounts of developmental works, it will be more expedient to exclude, in the next periods of irrigation, the regions of the fourth group. The prospects of irrigation of these areas will be improved fundamentally only under conditions of construction of a closed irrigation network and use of artificial rainfall.

The fifth group of meliorative regions (No. 5 on the map) includes the present-day saliniferous areas of Khaki, Botkhul', Tazha and others, which are situated in the present-day non-draining parts of the Caspian Lowland and which are the present-day centers of accumulation of salts. The extreme salting of the soils, proximity of ground waters (50-100 centimeters), their high mineralization (up to 150 grams per water), situated in a non-draining depression -- all this indicates that the regions comprising the fifth group, in view of the present level of irrigational-meliorative technique, are not suitable for irrigation.

3. KOLKHOZ IRRIGATION BY LOCAL RUN-OFF WITH WATERS OF SMALL RIVERS AND PONDS

Irrigation by local run-off in the Caspian Lowland has the most favorable prospects. Kolkhoz irrigated sections, which were visited and partially studied by expeditions, are located on the second terrace of the rivers, usually, or in the upper part of

valleys, on the slopes. In both cases, reservoirs are constructed in the river bed; the reservoirs are also the source of water. The water moves in a canal by means of "chigiry" or tractor pumps, and sometimes by gravity.

As shown by the work of the Valuyevsky experimental station, irrigation by local run-off, on the average, yields a harvest of 15-17 centners per hectare of grain, and on the non-saline sections up to 30-40 centners per hectare. However, together with the indisputably high effectiveness of irrigation by local run-off, individual cases of secondary salting of irrigated soils occur. Investigations by Yu. G. Lopato (Valuyevsky station), by the author (1937) and Professor N. I. Usov (1940) indicated that secondary salting during irrigation by waters of local run-off mostly is due to the supporting effect of the reservoirs, constructed to accumulate water, and the loss of water in the irrigation network. Both together cause the rising of the ground waters and the beginning of secondary salting in the vicinity of the reservoir or along the canals.

The study of cases of secondary salting of irrigated soils in Trans-Volga revealed two phases of this process:

(a) salting of the layers containing roots at a depth of 30-50-75 centimeters, when the ground waters are found at the level 300-250 centimeters; (b) salting of the surface layers of soils, when the level of the ground waters averages nearly 200-150 centimeters.

SECRET

In both cases the critical depth of occurrence of ground waters equals 175-200 centimeters. Salting, as a rule, appears not with compact areas but with separate spots -- chiefly in the solonetz soils which occupy mostly the positive elements of the microrelief. Later expansion and joining of the saliniferous spots cause the formation of continuous saline territory. Simultaneously, in the composition of the vegetation a change of species composition takes place and, as the experiment of the Novouzenskiy system shows, representatives of the prolific saliniferous halophytes appear.

Morphologically, salting is accompanied by the loss of the expressed acicular solonetz layer and the development of a sulfatic salt layer in places of evaporation of capillary solutions. In particular, bright-white, fine "apoda" are characteristic of the formation of gypsum, situated over the carbonate layer or, in case of surface salting, near the surface. In these same layers, an analysis of the aqueous infusions discloses also a maximum of chlorides and sodium sulfate. The amount of salts reaches up to 2-4 percent, that is, much higher poisonous limits.

The territories with the saline root-containing layers usually yield reduced harvests of grains (3-5 centners per hectare), and surface salting destroys harvests completely and sections are abandoned. Soils with an expressed surface secondary salting are found in the territory of the Valuyskiy station and the Novouzenskiy system.

In those cases where the natural drainage role of the river

valleys is preserved undisturbed, which occurs in the location of the irrigated section of the strip along the river valley below or above the reservoir, outside the zone of ground waters tributary to it, that is, on the protected heights of the terraces over the level of the water in the reservoir not less than 5-6 meters, then the soils not only are not salted, but, on the contrary, in the presence of irrigation, begin to lose their salt.

The clearest case of the de-salting of the soils in the presence of irrigation was detected by A. I. Kulikov in the northern part of the Piterok section on the terrace of the 'Alvy Uzun' River, on both sides. The de-salted areas and areas losing their salt here are located on a strip along the river 0.5-1 kilometer wide.

The intensive de-salting of soils by irrigation is described by N. D. Despalov in a somewhat different setting, on the territory of a Sovkhoz between the Torgun and Vodyanka rivers. Here, the valleys of the converging rivers, on the one hand, play the role of the source of water for the irrigated territory with the help of dams and dikes, and on the other, preserving in the interim period the level at 5-6 meters below the brow of the terrace, are the natural drains for the same territory. The converging valleys of the rivers below the irrigated section and dams promote the flow-off of ground waters from the area. On the whole, the irrigated sections are characterized by extremely favorable conditions of natural drainage. Thus, at the time of the investigation, in the center of irrigated section the level of the ground waters was 3.0-3.5 meters, and on the periphery, near the Torgun and Vodyanka

river, it was 5 meters and deeper. It is natural that in the given conditions the forty-year irrigation caused a considerable distillation of the soils, ground and ground waters. It is necessary to add that the most inundated part of the section, which lies toward the southern bank, is rather "obrazhenno" by thickly planted crack willows and aspens. This in its turn played a considerable role in the prevention of secondary salting.

The other examples of the de-salting of the soils by irrigation by means of undisturbed natural drainage were found by us on small irrigated sections near Irkutsk at the hamlet of Lantsug, where, in the upper part of the Lantsug River, were located gardens of Sovkhoz No. 1, and also irrigated gardens in the upper part of the Khara River near the hamlet of Pirogovoy. In both cases a strong leaching of NaCl and MgSO₄ from the soils to a depth of 100-250 centimeters was determined by the method of comparison with non-irrigated soils.

A similar picture of the leaching of salt from the soils by irrigation is observed for the many irrigated sections along the Dolishoy Uzen' River, Malyy Uzen' River and the Torgun River. Finally, K. A. Kalnin examined a small irrigated section near the village of Nevonikol'skiy, on a complex of solonetz soils, developed on chocolate loams. The ground waters here lie at a depth of 24 meters, and irrigation was carried out without any standard for the whole summer. Nevertheless, by 1932 (after, approximately, 10 years), according to the testimony of K. A. Kalnin, the section was not salted. The predominant changes in the soil covering in the leaching out of salt under the action of irrigation consist

of the deformation of the solonetz layer; it loses its consistency and adhesiveness and slaks down. Simultaneously is observed the reduction of the carbonate level (reactions with HCl and morphological concretions) and the extraction of gypsum.

Aqueous infusions disclose the lowering of the layers of chlorides and sulfates and the decrease of their amount. During all this, in the profile of the irrigated solonetz soils all continue to preserve the layer of pallicular-capillary accumulation of salts in the periods of drying. Thus, the leaching of salt have taken place all the time under conditions in connection with the ground waters.

In the salt-free irrigated soils is observed also the increase of clays at the expense of the reduction of the amount of the fraction 0.25-0.05 and 0.05-0.01 millimeters (according to Sabatin), the increase of the humus content containing nitrogen and free phosphorus. An improvement of the structure of the irrigated soil occurs. All this shows in the increase in fertility of the soils under the influence of irrigation.

The leaching out of salt does not always take place in this favorable direction. In certain solonetz soils at hay harvest, the leaching out of salts passes over to a clearly expressed "osolodeniye".

"Osolodeniye" appears in the formation of a typical whitish layer, chiefly at the expense of the disintegration of the solonetz soils. In the structure and color of this new layer it is possible to trace the entire transition to solcularity. The

SECRET

chemical "osolodeniye" appears clearest of all in the increased washing out of R_2O_3 and the relative accumulation of silica in the upper layers. In the composition of the salts, an appreciable quantity of chlorides and sulfates is still preserved.

Cases of the "osolodeniye" of solonchaks soils during irrigation are of interest from two points of view. Firstly, once again the genetical bond of the solonchaks soils and "sol" is exposed; and secondly, in industrial conditions the necessity of the chemical improvement of the most clearly expressed solonchaks soils is demonstrated. Otherwise, the "osolodeniye" will reduce the fertility of the soils during irrigation.

The question concerning the quality of irrigation waters acquires great importance during irrigation with local run-off. We have shown above, in the choice of processes of the migration of salts in the Caspian lowland, that the majority of rivers descending into the lowland have strongly mineralized waters. The degree of mineralization of river water is increased downstream (see Table 86), and also towards the middle of summer.

The interesting investigations of Yu G. Lopato, in connection with the Valuyevskiy station, determined that (1) irrigation water with a content of Cl near 0.6 grams per liter does not cause a specific increase of the chlorides in the soil during two wettings for one season; (2) water containing 1 gram per liter of Cl already enriches the irrigated soil with chlorides in an amount of nearly 1 ton of Cl for 1 hectare per season; (3) water containing 1.5 grams per liter causes a considerable salting of the

irrigated soils in the course of a season, with an accumulation in the one-meter layer of soils of somewhat less than 3 tons of Cl. Lepate calculated that for the non-saline solonchests chestnut soils of the second terrace the safe limit of concentration of Cl in the irrigated soils is 0.5-0.8 grams per liter.

In concluding this section, it is possible to formulate the following conclusions:

1. Kolkhoz irrigation by local run-off for grain and garden crops in the Caspian Lowland shows positive experiments of several years duration and has good prospects on sections situated on the second terraces of the rivers and in the upper parts of valleys and ravines. Crop rotation of grassy crops under irrigation permits a fundamental raising of the fertility of the soils.

2. The maximum salting of the irrigation waters in the local reservoirs must not exceed 0.5-0.8 grams per liter of Cl.

3. Measures to guarantee the prevention of secondary salting of the soils during their irrigation include a system of cultivation making full use of grass crops, economic planning of water utilization, prevention of filtration in the canals and correct location of the basic area of irrigated section along the bluffs of the second river terrace of the Trans-Volga rivers.

4. In order to preserve the natural drainage of the territory and to promote the de-salting of the soils, it is expedient, as far as possible, to build ponds, cisterns and reservoirs on the rivers of the Lowland, leaving 4-5 meters of the bluff of the terrace above the level of the water, in order not to shut off

completely the existing flow of ground waters.

5. From this point of view it is more preferable to plan a machine-pump water supply, which can be limited by the lower water levels of the reservoirs, and also to build a network of small reservoirs along such rivers as the Bol'shoy and Malyy Uzen', preserving the natural drainage of the adjoining territory.

6. In planning an irrigated section, it is necessary to take into consideration the existing ravine network and network of tributaries which dissect the terrace, locating the irrigation section and its parts so that this supplementary natural drainage network will be utilized for tapping the ground waters. But the reservoir must be situated in such a way that this secondary network of the natural drainages is not closed off and converted into a source of salinity.

7. The most hazardous territories, in the sense of secondary salting, which are found in the neighborhood of the reservoirs, in the case the latter is located on a level with or higher than the territory of the irrigated section, should not be irrigated and either utilized for orchard-wood planting (of course, in suitable degree of cultivation) or for the cultivation of grasses. The irrigation, however, of field cultivation in these areas will cause a salting of them.

8. The critical depth of occurrence of ground waters for the soils of the majority of the second terraces of the Trans-Volga rivers is 175-200 centimeters. Therefore, for the prevention

of salting and for normal development of cultivated plants, in the construction of irrigation sections the level of the ground waters should not be permitted to rise above a level of 2-2.5 meters from the surface of the soil layers.

2. All irrigation canals and ponds should have wood planted around them in order to prevent the rise of ground waters from the filtration of the water.

4. NON-IRRIGATED CULTIVATION IN HOLLOWES AND AGRICULTURAL PLANT IMPROVEMENT

In characterizing the meadow, dark-colored soils of the hollows in the Caspian Lowland, we noted their high quality, which results in natural preservation of moisture, great humus content and texture.

The soils of the hollows represent in the lowland that land fund insurance which, without great expenditure, solely on the basis of a complete grass crop system of cultivation, high-quality agricultural engineering and measures for retarding drifting snows, always will give good, stable harvests of high-value hard hyaline wheat.

Up to the present time, a part of the low-lying lands is found in waste lands, part is not tilled, and some, though it is plowed up, abounds in weeds. The immediate, urgent tasks of farming in the hollows are the introduction of correct crop rotation and prevention of weed growths. Together with the necessary and fundamental measures of weed prevention will be black fallow, earlier

shallow ploughing, fall ploughing and weeding of the fields, that is applied at the present in insufficient measure.

The second measure, which it is necessary to carry out simultaneously with the first, is the extensive prevention of snow drift with the help of plant screens, blinds and fencing. The chief role in snowdrift prevention and protection from drought in the valleys is played by the banks of field-protecting wood plants along the borders of the hollows and crosswise to the prevailing winds. In spite of the presence of saline solonchaks in the soil cover of the Caspian Lowland, the field-protecting tree-belts can be developed there with success, if attention is given to the selection of soil conditions for planting and care is provided for them during the first years after planting.

A protracted practical experiment in orchard cultivation and green planting in the Caspian Lowland, and also special experiments of our experimental station in the Behrangbek region on lands of the Khabaksha hollows, showed that wood plants are well-developed in their transplantation to the meadow soils of hollows from which the salt has been distilled, but not on solonchaks.

Therefore, for prevention of snow drift and protection from winds in the hollows it is possible to employ connecting and circular belts of trees (along the contours of the hollows).

For the preparation of the soil for planting, deep ploughing is necessary (30-35 centimeters). In the spring, after the plants

have been set out, careful attention is required for the plantings (weeding and cultivating) and complete eradication of the weeds.

At the end of the second year of vegetation, with good care, plantings of acacia, maple, elm, wild olive, "anorfa" already afford a dense strip, in which the acacias and maples reach a height of 2-2½ meters. From this time on (that is, after two years), the protective tree-belt begins to restrain and accumulate the snow.

The soils of the hollows, owing to their capacity to distill out the salt water and their humus content, possess high fertility. The spring reserve of moisture in the profile and in the ground water, which reaches 2500 cubic meters per hectare, can provide high yields of field crops. Even under conditions of primitive agro-techniques of the past, yields of grain crops in the hollows reached 20 centners per hectare. The use of strips and rings of field-protecting tree-belts, the eradication of weeds, black fallow, fall ploughing and crop rotation of grass crops will assure the securing of yet higher and more stable harvests.

The soils of the great hollows, well-provided for with moisture, are a high-value land fund in the territory of the Caspian lowland. The overall area of it comprises 25-30 percent of the territory of the northern and central parts of the Lowland. This, in large part available, land fund, by systematically drawing it into field cultivation, using agricultural-forest improvement measures, snowdrift prevention and correct agricultural engineering, will permit the creation of a local, stable grain cultivation, without irrigation, with yields of 20-25 centners per hectare.

50X1-HUM

SECURITY INFORMATION

CIA

FOREIGN DOCUMENTS DIVISION

50X1-HUM

REMIAN - AN ANALYSIS OF PSYCHOLOGICAL TYPES
BEHIND THE IRON CURTAIN

Monthly Periodical (Polish)

Kultura, Paris, No 7/85 -8/86, Jul-Aug 51

October 1951

KETMAN - Paris, Kultura, No 7/45 - 8/46, Jul-Aug 51

Czeslaw Milosz

The reasoning of an intellectual subject to the pressure of force and method is full of contradictions. It is difficult to comprehend these contradictions accurately, because we must deal with an entirely new phenomenon which does not appear in this form either among the Russians (the dominant nation) or among the adherents of the New Faith in the West (who are aided by ignorance). Citizens of the People's Democracies have no opportunity either to write or express themselves on these matters. Outwardly, such matters do not exist. Yet such matters do exist and constitute life itself for the actors who comprise nearly all the inhabitants of the countries subject to the Control, especially the representatives of the intellectual elite. It would be difficult to describe relations among these people as anything other than acting, with the difference that the place where the play is acted out is not the stage of a theatre but the street, the office, the factory, the meeting hall, and even the home. It is artifice requiring mental vigilance. Not only should every spoken word be swiftly appraised with regard to possible consequences before it leaves one's lips, but even a smile at the improper moment, or a glance which expresses more than it should, may be the cause of dangerous suspicions and reproaches. Likewise, the manner of living, tone of voice, and preference for one or another necktie are interpreted as signifying political leanings.

Arrival in the West is a great shock to a person from the East. When he meets strangers, beginning with the porter and the taxi driver, he encounters no defensive attitude; they are entirely relaxed; they lack the inner concentration which is expressed by the bowed head or the fleeting, uneasy eyes; they speak whatever comes to their minds; they laugh heartily. Is it possible for relations between people to be so straightforward?

This everyday play acting has this difference from acting on the theatrical stage: everyone plays his part for everyone else to view, and everyone knows that everyone else is acting a part. The fact that a person plays a part is not held against him and is not in the least considered evidence of deviation from orthodox views. It is only important that he play his part well, because a skilled portrayal of his role is proof that the part of his personality on which he builds his role is adequately developed within him. If a person delivers a harangue full of hate for the West, and if he does it with fervor, this is taken to indicate that he has at least 10 percent of the hate within him about which he so loudly proclaims. If a person condemns western culture in a rather cool and moderate manner, this means that in reality he favors western culture. As is known, all human behavior contains a significant amount of acting. Man reacts to his surroundings, and even his gestures are regulated by environment. His mental attitude is often determined by the attitudes of those who surround him. In the People's Democracies a conscious play of the masses is being enacted. If this conscious play acting is cultivated long enough it develops those personality traits in a man which are most useful to him in his actor's work. Thus the man who becomes a runner because of well developed legs, develops his legs even more to become better in a race. After a longer period of practice, he becomes so closely bound to his role that it is no longer possible to distinguish what is natural and what is assumed. The closest friends use the cliches of a public assembly. The actor and the role become inseparable and the tense vigilance can be relaxed. The proper responses at the proper moment are now automatic.

This also occurs in literature. The poet writing a propaganda piece does not limit himself in the least to a clear, rational concept. Just as the interpreter "infects" himself with the spirit of the original, so the poet convinces himself that the ideal poem is one

which can be recited by a chorus at a meeting, and gives vent to his emotions after the appropriate "tuning up". In the theatre, an actor playing the Oid is the Oid on the stage. Of course, not every actor, even if he is young and well developed can play the Oid. What is needed is the inborn ability to feel the role of the Oid. Poetry, as we have known it heretofore, may be defined as the expression of an individual temperament breaking through social conventions. On the other hand, the poetry of the New Faith may be defined as an expression of social convention breaking through individual temperament. Therefore, the poets endowed with dramatic talent are the most adaptable to the new situation: the poet creates a figure of the ideal revolutionary poet and writes his verse as a monologue for this figure. He does not present his own thoughts but those of the ideal citizen he has created. The result is reminiscent of a marching song, since the purpose is the same, creation of a collective chain binding the marching column of soldiers. The best example of such a song-slogan are some of the verses of the German poet Bertold Brecht. They surpass the works of other eastern poets since an entirely conscious process is visible in Brecht's works.

Although the merger of the role and the private thought are well advanced, there remains a vast area which requires vigilance. The constant masking of one's thoughts, although it creates an atmosphere difficult to bear, affords a good deal of satisfaction to those masking their feelings. By saying that something is black and thinking that it is white, inwardly laughing and outwardly showing solemn zeal, inwardly hating and outwardly showing affection, knowing but pretending ignorance - thus throwing the enemy off the scent as he does you, one begins to value one's own cunning above all. Success at this game becomes a source of satisfaction. At the same time, that which is shielded from alien eyes takes on a special value since it is never clearly expounded, and what

is not expressed in words possesses an irrational enchantment of a purely sentimental quality. Man shields himself in his internal sanctuary, which becomes the more beautiful the greater the price he must pay to bar access to it.

Play acting practiced on a mass scale has not often been encountered in the history of the human race. Nevertheless, in attempting an inadequate description of this new type behavior we encounter a striking analogy in the Islamic civilization of the Near East. Not only was the game of concealing personal thoughts well cultivated here, but it was transformed into a permanent institution in the name "Ketman".

Who is Ketman? A description of Ketman is found in the book by Gobineau entitled, Religions et Philosophies dans l'Asie Centrale. Gobineau spent many years in Persia (from 1855 to 1858 he was secretary of the French Embassy; from 1861 to 1863 he was the French minister) and one cannot deny his gift of keen observation, even if we do not necessarily agree with his conclusions of this rather dangerous writer. Ketman is so typical of a kind of behavior cultivated in the countries of the New Faith, that I will take the liberty of quoting at some length.

It is the opinion of the peoples of the Moslem East that, "the possessor of truth should not expose his person, possessions, or his reputation to the ignorance, folly, and maliciousness of those whom God willed to be born in error and remain in error". Therefore, one should remain silent about his real convictions if possible.

"However", says Gobineau, "there are instances where silence is not enough, times when it may reveal a person. In such a case he must not hesitate. Not only is it necessary to publicly renounce his views, but it is advisable to use various lies if only to confuse his adversary. Then he will utter any convictions that come to mind, he will go through various motions which he deems most nonsensical, falsify his writings, and utilize every means of deceit. In this way he obtains great satisfaction and reward from the knowledge that he has shielded himself

and his family, his precious faith has not been exposed to the remnant contact with the unbeliever. By deceiving his adversary, he leads him into error and brings down upon him the shame and spiritual poverty which he deserves.

"Ketman swells the ego of the person who emulates him. The believer attains a state of permanent superiority over the person he has deceived, even though the latter may be a minister or a powerful monarch. The person confronted with Ketman is a poor blindman who is deprived of entrance to the only true path and does not even realize this. On the other hand, you who play the part of Ketman, though ragged, starving, and appearing to tremble at the feet of a power skillfully misled, have your eyes full of light; you stride in splendor before your enemies; you sneer at the ignorant creature; you disarm the dangerous beast. What a multiple joy at the same moment!"

The heights to which Ketman may aspire is illustrated by the example of Haji-Sheik-Ahmed, founder of one of the sects. "Although he left many theological works behind him", says Gobineau, "he never clearly divulged in his books, as even his most ardent scholars will admit, anything which might border on the ideas which are attributed to him today. Nevertheless, it is generally certain that he played Ketman, that in hiding he revealed great boldness, and that he introduced very precise order into the doctrines which today bear his name". Therefore, there is no reason for amazement at the admission of a certain Persian to Gobineau that, "in Persia there is not a single perfect Moslem".

Not all, however, were as cautious as Haji-Sheik-Ahmed. To some, Ketman was of service during their preparatory period, and when they felt strong enough they openly proclaimed their heresy. The following is a description of the preaching trips of Sadra, an Avicennist:

"... He also was afraid of the mullahs. It was impossible to avoid arousing their suspicion, but to give sound arguments and to furnish evidence against their accusations meant submitting to an endless

persecution, and endangering the philosophical rebirth which he intended for the future. He adapted himself to the demands of the time, therefore, and fled to the great and glorious sanctuary as exemplified in Ketman. Whenever he came to a town he was careful to present himself humbly to all the local mujtahids and doctors. He sat in a corner of their salon, usually remained silent, spoke modestly, and agreed with every word uttered by these venerable men. He was asked about his knowledge. He expressed only ideas borrowed from the most orthodox Shiitic theology and in no way betrayed his interest in philosophy. After a few days, the mujtahids themselves, seeing that he was meek, proposed that he preach to the public. He proceeded to do so immediately, took as his text the doctrine of ablation, or something of this sort, and discoursed on the precepts and doubts in the consciences of the most subtle theorists. Such behavior drove the mullahs to rapture. They exalted him to the skies and forgot to supervise him. They themselves asked him to introduce them to less common questions. He did not refuse. From the doctrine of ablation he turned to the doctrine of prayer, from prayer to revelation, from revelation to the unity of God. At this point, accomplishing miracles of dexterity, using tacit assent and avowals in the presence of the more advanced scholars, self-contradiction, double-talk, false syllogisms which only the initiated could understand, and interweaving everything abundantly with declarations of his irreproachable belief, he finally reached his goal and propagated Avicennism. When he finally realized that he could come into the open, he dropped his veil, denounced Islam and revealed himself solely as a logician, metaphysician, and the man he really was.

The Ketman of Islam and the Ketman of 20th century Europe differ in only one respect: the boldness which Sadra attained would have had a bad ending for him in Europe. Nevertheless, the role of Ketman in its very narrow and basic forms is universally cultivated in the People's Democracies. As in Islam, the feeling of superiority over

those unable to perceive the real truth is one of the chief joys in the lives of those whose lives generally do not abound in joys. "Deviations", which the government suppresses with so much trouble, are not idle fancy. These are instances of Ketzman unmasked. The most useful people in uncovering deviations are those who themselves act a similar type of Ketzman. Easily recognizing the acrobatic turns in others since they practice them themselves, they utilize the first opportunity to destroy friend or foe. They secure their own positions by this, and exhibit their own skill in protecting themselves against a similar accusation from the person who is destroyed. Since the varieties of Ketzman are almost limitless, there are more types than can be named. Each new commentary on the precepts of the New Faith, announced by Moscow as binding on all, multiplies the mental reservations of those who outwardly appear most faithful. Enumerating all the versions of Ketzman which can be discerned in the People's Democracies would be impossible. We shall attempt, however, to cover the main family types.

The nationalistic Ketzman. This type Ketzman is not only general among the wide masses, but is found even among the party heads of various countries. Because Tito, like the Sadra described by Gobineau, proclaimed his heresy to the entire world, many millions acting Ketzman in the People's Democracies must resort to especially ingenious means of concealment. Show trials of the adherents of the "national road to socialism" in various capitals of the east, have taught the public what kinds of phrases and responses may imperil the safety of a person harboring such tendencies. The surest way to escape a reproach is to manifest your admiration for the achievements of the USSR in various fields at every turn, to carry Soviet literature and books under your arm, to hum Soviet tunes, to praise Soviet musicians and actors, etc. The writer, who has not devoted a single work to an important Russian figure or to Russian life, but has limited himself to themes of his own country, cannot be secure. The mark of people cultivating this type

DISCLOSURE

of Kretan is boundless contempt for Russia as a barbarian nation. The workers' and peasants' attitude towards the Russians is emotional, based on observation of the soldiers of the army of "liberation". Since many people lived in territory directly administered by the Russians during the war, their attitude is based on an observation of the Russians in everyday life. Since the standard of living and level of civilization in the USSR has been lower than the countries now called the People's Democracies, the role of the nationalistic Kretan yields tremendous comfort. It is not strictly nationalism. For a great many centuries hatred has existed between the Slavs of Central Europe and the Germans, but the hatred was mingled with respect for the external signs of civilization perceptible in the Germans. On the other hand, the Central European would express his opinion of the Russian, if he could, by a contemptuous wave of the hand. This, however, does not deny the fact that he fears the great masses pouring out of the depths of the Euro-Asiatic continent.

This is not a matter of the emotions alone. Among the young working class intelligentsia the prevailing opinion could be summed up as: "Socialism - yes. Russia - no". This is where the subtle differences of doctrine begin. The countries of Europe, so the argument goes, are in a much better position to effect Socialism than Russia. Their people are more intelligent, the major part of the land is under cultivation, the transportation network is more dense, and industry does not have to start at a point near zero. Indiscriminately ruthless methods are not needed since there is a higher level of social discipline present. Nevertheless, "the national road to Socialism" has been stigmatized, and whoever opposes the complete adaptation of the Russian model in the smallest detail and does not surrender to the dictates of the Centrum is a traitor and must share the destiny of Tito, that is come out against the Centrum and weaken the war potential of the Centrum, which is the sole means of bringing about a world

DISCLOSURE

RESTRICTED

revolution. Declarations against this theory would signify a trans-
gression of the New Faith and the substitution of another faith, stemming,
for instance, directly from Marx and Engels. Sadra, who in reality was
outside the realm of Islam, was concerned with keeping this fact con-
cealed in the presence of the mullahs. Likewise, many apparent be-
lievers in the New Faith are in reality outside the faith. Others,
see in the alliance of Tito and the West an example of historical
fatalism, but reject the idea that this fatalism could be brought
about by a deliberate policy toward subjugated nations. They assume
the Ketman that does not hamper the Centrum in its external acts. A
faithful Moslem, even one deeply attached to his Ketman, cannot hamper
Islam's battle for its existence with the unbelievers. This type of
Ketman, therefore, is externalized only in practical moves which do
not impair the world struggle. On the other hand, he protects national
interests where that is still possible.

The Pure Revolutionary Ketman. This is a rare variety more
common in the great cities of the USSR than in the People's Democracies.
It requires a belief in the "holy fire" of the revolutionary era of
Lenin, which the poet Mayakovsky symbolized. Mayakovsky's suicide
in 1930 marked the end of this era, distinguished for its full-blown
literature, drama, and music. The "holy fire" was dammed, collecti-
vization was instituted in a ruthless manner, millions of Soviet
citizens died in forced labor camps, and a ruthless policy was applied
to non-Russian nations. Under the influence of preordained theories
literature became shallow and colorless; art was destroyed; the Russian
theatre, once the foremost in the world, was deprived of experimental
freedom; science was subject to directives from above. The Ketman of
revolutionary purity hates Him /Stalin/ with all his heart, holding
Him responsible for the terrible fate of the Russian nation and for
the hate which the Russian nation develops in other nations. He is
not certain, however, that He is not needed. Perhaps, in exceptional
periods such as the present, the appearance of a cunning tyrant is

desirable. The mass purges in which so many good Communists perished, the decrease in the standard of living of the citizens, the transformation of artists and scholars into acquiescent hirelings, the extermination of entire national groups - who but He would have dared similar acts? And besides, Russia had resisted Hitler. The work of the revolution did not yield to a power striking from without. Viewed in this light His acts appear wise and efficacious, and are justified, perhaps, by the exceptional historical situation. Since if He had not adoped exceptional terror in 1937, would not there have been more people willing to help Hitler than there were? Does not today's trend in science and art, however contrary to sanity, admirably raise the morale of the Russian people in the face of a threatening war? He is a blot on the bright New Faith, but a blot which even today should be tolerated and even supported. The "holy fire" is not out. When victory has been achieved this fire will break out again with its old force, the chains which he imposed will be broken, and relations between nations will be based on new and better foundations. This type of Ketzman was very frequent if not universal in Russia during World War II, and today's form is a revival of earlier disappointed hopes.

Ketzman - the Aesthete. A man of good taste must not attach too much importance to the results of official pressure in the cultural field. He applauds verses, writes flattering reviews of art exhibits, and pretends that the gloomy plans and heavy architecture of the new buildings please him very much. Things are different within the four walls of his home. Here may be found (if we are dealing with a comfortably situated intellectual) reproductions of works of art officially condemned as bourgeois, records of contemporary music, and a rich collection of books in various languages by authors of the past. The luxury of privacy is excused if the creative work which he turns out produces the expected propaganda effect. In order to safeguard his position and residence (a favor of the state), the intellectual is

RESTRICTED

ready for various sacrifices and various artifices. The value of privacy in such a society is even greater than that expressed in the phrase, "my home is my castle". Television screens in private homes to check on the behavior of citizens are still a thing of the future, therefore, listening to foreign radio stations and reading good books is done in moments of leisure and solitude. With the appearance of guests, the play acting begins anew.

No exact determination has ever been made as to how much human beings require experiences which may inaccurately be termed aesthetic experiences. Only ~~in~~^{for} a small number of individuals in any society derive such experiences from works of art. The majority of people draw aesthetic pleasures from the mere fact of existence. In the cities the eye sees colorful shop displays and varied types of people. A person's imagination in a crowd is of an erotic nature and ^{his} emotions border on the physiological. The eyes glory in the sight of people's attire, bright lights. The Parisian market stalls with their bunches of vegetables and flowers, fish of various forms and color, the fruit, the rows of meats of various hues of glaring red, all these afford pleasure which makes the paintings of the impressionists or Dutch masters unnecessary. Man's sense of hearing catches the fragments of an aria, the sound of machinery mixed with the warbling of the birds, calls, and laughter. The sense of smell notes various odors, coffee, gasoline, oranges, fresh air, roasting nuts, perfumes. The bards of great cities have devoted many odes to descriptions of this joyous plunge into the reservoir of universal life. The swimmer, who allows himself to be carried by the waves and has a feeling of the immensity of the elements surrounding him, has a similar emotion. This applies to the greatest bards of great cities, Balzac, Baudelaire, and Whitman. This participation in all things seems to depend on the constant expectancy of surprises and mystery, and becomes a search therefor.

In the countries of the New Faith the cities are losing their

RESTRICTED

RESTRICTED

old appearance. The elimination of small enterprises gives the streets a stiff and formal look. The chronic lack of consumer goods makes the crowds appear uniformly shabby and uniformly poor. When consumer goods do appear, they are of a single substandard quality. Fear paralyses individuality and forces men to make themselves look as similar to the average man in gestures, attire, and facial expression as possible. The cities are filled with a racial type approved by the rulers: short, square men and women with short legs and broad hips. This is the proletarian type. These same dummy men and women could change their appearance entirely under the influence of films, art, and fashion, as occurred in America, where "public opinion", which is really a desire to look like the models exhibited by the media of mass education, had as much influence if not more than better nourishment. The streets, factories, and meeting sites are full of red placards with slogans and standards. The architecture of the new buildings is monumental and depressing, lightness and joy in architecture are eliminated as formalism. When foreign visitors arrive for an international propaganda congress, greater amounts of goods are dumped into stores, the monotony of the streets is relieved with more slogans, and an attempt is made to create the appearance of carefree traffic. However, the number of aesthetic recollections which the inhabitant of the cities of the New Faith receives is usually limited. The sole place of enchantment is the theatre, since the magic of the theatre exists even if shackled by the orders of socialist realism, which defines the subject of art and the staging. Hence, the huge success with which the public greets the works of by-gone authors such as Shakespeare. Their imaginations overcome even the limits of a modern setting. The hunger for the theatre in the countries of the New Faith is so great that it should move the rulers to thought, but it probably does not, since they regard these thirsts as wreckage of the past.

In the rural regions, where the entire present-day manner of life

RESTRICTED

RESTRICTED

is to be abolished by transformation of the peasant into an agricultural laborer, there still exist remnants of a peculiarly peasant culture which was slowly formed during the centuries. However, in all truth, the main support of this culture were primarily the medium or richer peasants. The conflict with these peasants and their self-concealment must result in the decline of peasant dress, decoration of cottages, cultivation of private orchards, etc. There is a certain contradiction between the official guardianship over folklore (song, dance), to whose development much care is devoted, and the requirements of the new economic system, whose ultimate achievement must be the barracks or the walled compound inhabited by many families. With the closing of churches, elimination of Catholic holy days, and elimination of country fairs, it will be possible to make the same valid observations about rural laborers as are made about the urban population.

Under such conditions the aesthetic Kotman has many opportunities for growth. He is expressed in the subconscious longing for wonders (which the government attempts to channel in the direction of controlled amusements, that is, the theatre, cinema, and folk pageants), and in writers and artists, by various modifications of escapism. The writers scrounge around in old books and comment on and publish the works of old authors. They willingly write for children since the freedom of phantasy is somewhat greater. Many of them choose university careers since research on the history of literature affords a safe pretext for plunging into the past and for associating with works of great aesthetic value. The number of translators of old poetry and prose also multiplies. The artists seek an outlet for their illustrations in children's books, where the choice of brilliant colors may be justified as an appeal to the "naive" imagination of children. The theatre stage-managers, in payment for the presentation of bad contemporary works, endeavor to include Lope de Vega or Shakespeare in

RESTRICTED

RESTRICTED

their repertoire. Certain representatives of the plastic arts are so daring that they almost disclose their Katman in pleading for beauty in everyday life, and calling for the creation of special institutes to design textiles, furniture, glassware, and ceramics for industry. They even obtain the support of the most intelligent dialecticians of the party elite, and the money for such undertakings. One must have a great regard for such efforts (consider for instance, that before World War II, Poland and Czechoslovakia, besides Sweden and Finland, were the leading countries in interior decorating). Nevertheless, there seems to be no explanation for the fact that that which passes as formalism in painting and architecture should be tolerated to a greater extent in the applied arts. But, since everything is planned in a socialist economy, why should not there be planned satisfaction of the aesthetic needs of the people? Here, however, we trespass on the insecure sphere of the demon Psychology. To admit that the human eyes need jocular colors, harmonious forms, and clear and bright architecture would mean that the taste of the Centrum was bad. Nevertheless, progress can be discerned even there. Skyscrapers have already arisen modeled after buildings which arose in Chicago around the year 1900. It is possible that in the year 2000 art which passes as modern art in the West today might receive official approval. However, if aesthetic experience arises from physical experience, the linking of colors and harmony with Fear is as difficult to imagine as bright plumage in birds of the northern tundra.

Katman in Professional Work. Man reasons that since he finds himself in a situation which he is powerless to change, and since he has only one life and this passes, he should endeavor to make the best of it. He is like a shellfish clinging to a rock on the bottom of the sea. Storms rage above him, great ships sail above him, but all his efforts are expended in clinging to the rock, or he will be carried away, perish, and leave no trace behind him. Thus does Katman

RESTRICTED

RESTRICTED

develop in professional work. If a person is a scholar he takes part in congresses at which reports are read which strictly follow the party line. However, in his laboratory he proceeds in his research according to scientific methods, and in this he sees his life's goal. If his work is successful it does not matter how the work is presented and who receives the praise. The results achieved in the name of a disinterested search for truth are lasting, on the other hand, the shrieks of the politicians pass away. Everything they decree must be done and they are at liberty to use his name, if in return, he has access to a laboratory and the money to purchase scientific instruments.

If a man is a writer, his published works are taken into consideration. Here is a treatise on Swift. It was written using Marxist analysis. This analysis, however, gives a very good and penetrating insight into historical phenomena and is not synonymous with the Method and New Faith. Marx was a brilliant observer. In imitating him a writer insures himself against attack since Marx commands the position of a prophet. Nevertheless, the writer can state in the introduction that he is a believer in the New Faith which fulfills the same prerequisite as the dedication to the king or emperor in the past. Here is the translation of a long poem from the 16th century: does not this have some permanent value? Here is my novel on a theme taken from the remote past: it attempts to present past events as faithfully as possible. Here are my translations from the Russian. They are well thought of and have brought me a lot of money, and of course Pushkin is truly a great poet whose worth does not change just because today he serves Him as a means of propaganda. Of course, an author must pay for the privilege of working at his profession by turning out a certain number of articles and verses as homage. However, a person's life is not judged from occasional panegyrics written from compulsion. Even Mickiewicz, the great Polish poet, had to dedicate his poem to the Czar he hated, and in his dedication he did not spare

the praise. He did it because he was trapped, and when he cleverly escaped from Russia he revealed his real sentiments and his slyness is not held against him.

The attitude of Ketman in professional work constitutes an important motive to obtain education or skill in some special field in which a person can expend his energy, and by which a person can shield himself from the fate of a functionary who is entirely dependent on political fluctuations. The son of a laborer who becomes a chemist achieves permanent gain. The son of a laborer who becomes an official of the security police rises to the surface of a sea traversed by great vessels, but the surface of the sea is changeable and stormy. The most important things, like chemical experimentation, construction of bridges, the art of poetic translation, and treatment of diseases, are basically free from falsehood. The state, nevertheless, benefits from this Ketman because chemists, engineers, and doctors are necessary. From time to time, it is true that angored muttering is directed from above against citizens cultivating Ketman in the field of the humanities. The supervisor of literature in the Centrum, Fadleyev, piled abuse on the University of Leningrad in one of his harangues because a student wrote her master's thesis on the English poet, Savage Landor. "Who cares about Landor? Who ever heard of him?", shrieked Fadleyev. Likewise, in the countries subject to the Centrum, moderation and caution are indicated for those enacting this type Ketman.

Ketman in Philosophy. The philosophical Ketman is readily cultivated in intellectual circles. Humanity, it is reasoned, cannot cope with its knowledge, or solve the problems of the production and distribution of utilities. The first attempts at a scientific solution of social problems made in the 19th century are interesting but too impractical. However, they fell into the hands of the Russians, who can only think dogmatically. They raised these early experiments to the dignity of a

RESTRICTED

religious dogma. That which is taking place in the USSR and the countries subject to the USSR is a type of insanity. It is possible, even probable, that Russia will be able to impose its insanity on the entire world, and that the awakening will not occur until 200 or 300 years hence. While we are in the very middle of a historical cyclone it is best to behave in the most prudent manner and outwardly yield to the forces which destroy all opposition with ease. This does not preclude enjoying one's observations, since the present is truly exceptional. Never before was man subject to equal pressure and never before has man had to adapt himself to such a confining mould. All his intellectual and emotional capacity is being tested. Whoever views this daily self-denial and degradation knows more about man than any of the citizens of the West, where money is the sole means of pressure. This type Ketman tolerates outward conformity to the arbitrary line, in this he is aided by his complete lack of faith in the rationality of the Method. He is a cynic, and therefore is flexible in adapting himself to changing tactics.

Ketman in Metaphysics. This type of Ketman is especially common in countries with a Catholic background. Poland can supply the most examples in the Empire. Among other nations, Spain has had good Catholics cooperating with the Communists. This type Ketman requires the suspension of the concept of a metaphysical foundation of the world. This type of Ketman considers the age in which he lives as one in which no metaphysical faith can appear, because of peculiar circumstances. People learn to think in rationalistic and material terms, and are entangled in immediate problems and class warfare. On the other hand, religions undergo schisms, pass through periods of decline, and serve to defend the old social order. This does not mean that in the future humanity will not return to a better and purer religion. Who knows if the New Faith is not the indispensable purgative, and that the work of God will not be carried out by the barbarians, or rather,

RESTRICTED

the Centrum, which will force the masses to awaken from their lethargy. The spiritual nourishment which the masses receive from the New Faith is of a second-rate quality. The Centrum errs in believing that the nourishment which it can offer these masses is sufficient. Nevertheless, we should credit the New Faith with breaking the ground and destroying facades which are splendid only on the outside but are completely rotten inside and exude a stinky odor. Therefore, a person should support the New Faith without betraying his attachment to the Mystery, all the more since modern man has developed neither the means of expression nor a store of concepts adequate to reveal the Mystery. This type Ketzman has numerous variations. Some faithful Catholics even serve in the security police and suspend their Catholicism for this wholly ruthless work. Others attempt to preserve a Christian communion in the midst of the New Faith, and publicly proclaim their Catholicism. They endeavor to retain the Catholic institutions and often succeed because the dialecticians favor so-called "progressive Catholics" and "patriotic Catholics" who are submissive in political matters. The rulers tolerate this type of Catholic as a passing, necessary evil, since the stage has not yet been reached where religion can be entirely destroyed, and it is better to deal with favorably disposed religious followers than hostile religious followers. The "progressive Catholics", on the other hand, are aware of their unflattering positions as witchdoctors of a wild tribe, tolerated until the savages are dressed and sent off to school. They are found in various governmental enterprises and are even sent abroad as examples to the Western savages of the tolerance of the Centrum for the uncivilized. They are like the "resident savages", who are kept by colonial states for the celebrations in the metropolis. Their defense against ultimate degradation is the metaphysical Ketzman. They deceive the devil, who believes that he has deceived them, since the devil knows well that they believe that they are deceiving him, and is satisfied.

RESTRICTED

It is not only the Catholics, however, that recognize this type of man. That which has been said of the Catholics may be applied to other faiths, as well as persons without any denomination. One of the most dangerous accusations against a writer is the suspicion that his verses, theatrical works, or novels contain a "metaphysical residuum". Since the writer is a civilizer and not a witchdoctor, any signs of metaphysical leanings whatever are unforgivable. The literature of countries not subject to the influence of the New Faith until World War II betrayed especially strong leanings in this direction, hence the search for this type of deviation is still fruitful. For example, drama which is preoccupied with the tragedy of life does not have a chance of appearing in a theatre. The tragedy of man's fate provokes thought about the mystery of man's destiny. It is forgivable in bygone authors like Shakespeare, but there can be no thought of a contemporary author succumbing to this idea. For the same reason, the Greek tragedies are not considered suitable for a theatrical repertoire. Marx idealized the Greek traditions but let us not forget that the bond between the New Faith and Marx is only superficial. The New Faith is a Russian creation, and the Russian intelligentsia which created it had the utmost contempt for art which did not directly serve society (other functions of art, the most social of all, completely evaded their understanding).

Poetry, since its wellspring is difficult to distinguish from the wellspring of religions, is especially exposed to suspicion. To be sure, the poet is free to describe the woods, mountains, and flowers, but to exult in nature, as did Wordsworth on his visit to Tintern Abbey, incurs stigma. This is a good means of eliminating the legions of bad poets who make public confessions of their pantheistic flights of fancy, but it is also a means of eliminating poetry entirely and substituting works similar to the singing commercials in American radio.

The painter may be accused either of abstraction and formalism, or of contemplative delight in worldly beauty, which makes the painter liable to the charge that he is metaphysical in temperament. The musician should attempt to make his compositions amenable to an interpretation with every-day application (enthusiasm in work, entertainment of the people). His compositions should contain nothing difficult to understand, and hence open to suspicion. Thus, although the metaphysical Ketman is tolerated among the "savages"- the adherents of Christianity, he is not acceptable among artists, who are considered the educators of ⁶ society.

Ketman in Ethics. The ethics of the New Faith are based on the principle that all that serves the interests of the revolution is good, and all that impairs these interests is bad. Since correct behavior in the mutual relations of citizens aids the building of Socialism, great emphasis is placed on the morality of citizens. Demands made on Party members in this respect are especially severe. Asceticism is well nigh required of them. Acceptance into the Party is not very different from entering a monastery, and the literature of the New Faith treats the subject with the same gravity as Catholic literature treats the vows of new monks. The higher a person moves in the Party hierarchy, the more closely his personal life is watched. Such traits as love of money, drunkenness, and unrestrained eroticism disqualify a Party member and make it impossible for him to hold more important positions. The top level of the Party contains persons with all the ascetic characteristics, dedicated to a single task, revolution. In people who serve as tools but possess no actual influence, weakness is tolerated, even encouraged, (even if they are Party members) because weaknesses such as love of luxury and drunkenness guarantee obedience. Puritanism, however, is the ethical ideal of the New Faith. If it were possible to put all the citizenry in cells and let them out only

RESTRICTED

for political meetings and work, this would doubtlessly be the most desirable. Unfortunately, this violates human nature. Procreation is only possible through sexual relations between men and women, and this inconvenience has to be reckoned with. Nevertheless, care is taken to create an asexual atmosphere in collective life and to destroy the femininity of woman, because she is needed as a laborer and excessive femininity would make her use for the heaviest type of work (mining and metallurgy) impossible. It is evident that the aesthetic ideal of the Centrum (short, sturdy, ugly women) may be very useful in realizing the great goal of world revolution.

The "new man" is trained to recognize the good of the whole as his sole rule of conduct. This rule, however, results in conflict at every turn. For example, a man has a very dear friend who has confided that he has political doubts. The good of the whole requires that he immediately report the opinions of his friend to the proper authorities. Should he do this? The New Faith replies without hesitation: yes. The "new man" should be ready to kill his own mother if her existence is an obstacle to the revolution.

Cardplaying and drunkenness are considered serious crimes because they may cause a person to become careless and thereby inflict injury on the whole. Retiring to one's room and daydreaming is also a transgression since isolation injures communal work and only communal work results in positive achievements for the whole. The same applies to stubbornness in holding one's views, irony, self-conceit, and in general, all signs of a developed individuality. The ideal "new man" thinks and reacts like everyone else, is modest, industrious, satisfied with what the state offers him, limits his private life to nights spent at home, and always associates with his colleagues at work and at play. He diligently observes his surroundings and reports to the authorities on the thoughts and actions of his associates.

Informing has been known in various civilisations. Generally

RESTRICTED

RESTRICTED

speaking, it has never been raised to the dignity of a virtue. In the civilization of the New Faith it is regarded as a basic virtue of good citizenship (although they carefully avoid calling it by its name, using "discussion" instead). It is the foundation on which is based the fear of one man of another. Work in the offices and factories of the countries of the New Faith is difficult not only because of the amount of effort expended, but also because constant vigilance against the omnipresent and sensitive eyes and ears is very exhausting. After work a person attends political meetings or special lectures, and thus the day drags out without a moment of relaxed vigilance. A sincerophat, if encountered at all, is a bad sign. A person may simulate a relaxed or carefree attitude, sympathy or anger only to gain a person's confidence in order to write a report.

Thus, ethics based on the cult of the "whole" becomes poison for the whole. The dialecticians have made allowances for the physical weaknesses of the people. However, they will not admit that man has other weaknesses, that he feels better when he can relax his vigilance, and worse when he lives in fear. The inclination to better one's position at the expense of others destroys ethics based on cooperation and brotherhood and produces the ethics of one man in conflict against the other. The most cunning individuals are the best equipped to survive in this conflict. This is probably a different type of man from the man who had the greatest chance to survive in the struggle for money during the beginnings of industrial capitalism. Court-yard dogs may be classed as either the brutal and noisy type or the sneaky and silently biting type. It would appear that the second type is prominent in the countries of the New Faith. Fifty or 100 years of breeding according to such principles may create a race of man from which there will be no turning back. The "new man" is becoming a reality.

RESTRICTED

RESTRICTED

The ethical Ketman arises from the feeling that ethics of loyalty to the whole has numerous weak points. The feeling is not rare among high Party personalities. These people, although capable of murdering millions of people in cold blood in the name of the revolution if necessary, strive to some extent to modify their severity, and in personal relations are more honest and better than most people governed by individual ethics. Their capacity for sympathy and helpfulness is almost unlimited. Along with other reasons, the capacity for sympathy propelled them in their youth on the road to revolution. Thus, they relive the experiences of Marx himself. This type Ketman is often encountered in old Communists. When they come face to face with a conflict between the ties of personal friendship and the interests of the cause which they serve, they weigh the matter in their conscience for a long time and are merciless only when they are certain that by shielding their friend or refraining from indicting him, they injure that which to them is most precious. They are usually held in high esteem as almost-sure men. This does not free them, however, of frequent suspicion of "intellectual scruples" (intelligentskosc). "Intellectual scruples" is a derogatory term applied to those who may be blameless theoreticians but whose excessive consideration for ethics hampers their actions. The revolutionist should be completely indifferent, and would sooner fell trees at random than stop to consider which are truly rotted.

Plainly, the ethical Ketman is strongest in the People's Democracies, since the ethics of the New Faith has been recently planted there while the opposing ethics has existed there for hundreds of years. It is never possible to foresee when and in whom this Ketman will appear. This results in astonishing surprises: Those who give a person every reason to believe they are not informers are habitual informers; on the other hand, those who are most likely to be free of "prejudice" show an unexplained loyalty to their friends and even strangers.

RESTRICTED

This type Ketzman, which makes thought control difficult, is diligently combatted, but the number of situations in which the type appears is so great that he often evades repressive measures.

The inhabitant of the West is entirely unaware of the fact that millions of his neighbors, who are outwardly more or less like him, live in a world as fantastic as life on Mars. By comparison, the Westerner is a naive child, since he is not cognizant of the perspective into human nature opened by Ketzman. Is it any wonder that the Soviet diplomats surpass their Western colleagues in skill? Living under constant internal strain develops dormant talents in man. He has no idea of the heights of cleverness and psychological acuteness man is capable of when he is backed against a wall and must be either dexterous or perish. The survival of persons most adaptable to mental acrobatics creates a type of man who till now has been little known in Western Europe. There is no doubt that the necessity, which produces Ketzman, develops the intellect. Anyone who gauges the intellectual life of Central and Eastern Europe by the monotonous articles appearing in the press of this area and by the stereotyped speeches delivered errs badly. This is only an external cover. A peculiar style, terminology, and linguistic ritual has been adopted there. Just as the theologians during the times of strict orthodoxy expressed their views according to the stilted language recommended by the Church, so in Eastern and Central Europe it is not important what a person said, but what he wanted to say, concealing his thought by shifting a comma, inserting "and", and discussing problems in one order and not another. A person who does not live there has no idea of the number of titanic battles which are waged, the number of fallen Ketzmen, or the causes over which the fighting goes on. The people engaged in this difficult game of philosophical chess, refer to their compatriots-political emigrants with indulgence. The surgeon cannot consider the butcher his equal in skill. Likewise, the Pole, Czech, or Hungarian trained in special

24

RESTRICTED

RESTRICTED

pursuits is amused when he hears that someone in exile has called him a traitor (or swine), at the same moment that that traitor (or swine) is engaged in a drama on whose result the fate of 15 laboratories or 20 art workshops depends. Those abroad do not know what is bought and at what price.

Ketman as a social institution has certain advantages. To evaluate these advantages it will suffice to examine life in the countries of the West. The people of the West, and especially the intellectuals, suffer from a peculiar kind of *tedium vitae*. Their emotional and intellectual life is too scattered. They vainly try to contain the stream which spreads over a wide bed of gravel into a confining trough. Or, to use another comparison, everything which they think or feel evaporates like steam into the limitless expanse. The dog is a burden for them. No conclusions at which they arrive are binding; it may be thus, but it may also be otherwise. The hardest appear to be those who remained Communists. The system in which they live presents a wall against which they beat. They have found resistance and this resistance defines their own existence. Under pressure, even greater energy is generated by those who must conceal their Communist convictions that is, cultivate Ketman, a role not too common in the countries of the West.

As is evident, Ketman arises in response to opposition. If the opposition were suddenly removed, Ketman would find himself in a wilderness, which might be much more disagreeable. Internal rebellion is sometimes necessary for health, and it affords a particular variety of happiness. That which can be expressed is much less interesting than the emotional game of defending one's own sanctuary. It appears that the necessity of living under constant oppression and vigilance is a torture to most people, but to many intellectuals this simultaneously brings a masochistic pleasure.

He who practices Ketman lies. However, would he be less deceitful

25
RESTRICTED

RESTRICTED

if he were able to express the truth? The painter, who attempts to smudge the illicit rapture (metaphysical) of a beautiful world into a painting on the theme of life in a kolkhoz, would be lost if he were given free reign, since the world appears the more beautiful the less freedom he is allowed in presenting it. The poet dreams of that which he would write if he were not bound by his political obligations, although perhaps that which is beautiful in his dreams might disappear the moment he were freed from these obligations. Kertman fosters dreams. Man learns to love the fence built around him. The lack of an internal core in man may be the secret of the success of the New Faith, its great charm for the intellectuals. The New Faith, subjecting man to pressure, creates an inner core, and in each instance creates within man the feeling that this inner core exists. Fear of freedom is the fear of a void. A dialectician once said, "Man can extract nothing from himself since there is nothing there. Man cannot withdraw from people and write in the wilderness. Man is a function of social forces. He who would be alone perishes". This is certainly correct, but it is doubtful whether this can be recognized as something more than the law of our times. Man, if he felt that there was nothing in him, could not have written the Old and New Testaments, and the Divine Comedy, nor could he paint a single still-life of Chardin. Today, in admitting that there is nothing in him, he is willing to accept anything, even though he knows it is bad, just to be in company and not alone. So long as he thinks in this way, his behavior cannot be censured very much. It is better to cultivate Kertman and yield to the pressure which gives him the fleeting illusion of existence, than to risk disaster in the belief in the wisdom of the past ages, which maintained that man is a divine being.

What if he should try to live without resistance and without Kertman, to challenge destiny, to say: "If I lose I will not regret it"? If man

RESTRICTED

is able to live without outside resistance, if he is able to create his own resistance, then it is not true that there is nothing in man. This would be an act of faith.

50X1-HUM

RESTRICTED

SECURITY INFORMATION

C I A

FOREIGN DOCUMENTS DIVISION

50X1-HUM

October 1951

Geological Guide to the ^{7 miles} Excursions Held in Connection with the
Anniversary Celebration of the Geological Institute

**Geologischer Fuhrer zu den Exkursionen, Vienna,
May 1951**

[This report has not been edited
or prepared for publication]

RESTRICTED

Proj: 10071

RESTRICTED

TOURS
GEOLOGICAL GUIDE TO THE EXCURSIONS HELD IN CONNECTION WITH THE
ANNIVERSARY CELEBRATION OF THE GEOLOGICAL INSTITUTE

Geological Guide ^{to} ~~the~~ *Tours* ~~Excursions~~

Table of Contents

Introduction

- A. *Tour* ~~Excursion~~ into the Korneuburg Basin and the Northern Intra-Alpine Basin,
 by F. Grill. With contribution by F. Jaeschek on the Surroundings of
 Zistersdorf.
1. Geological Summary
 2. Vienna-Korneuburg; the Teinitz Mt in the Korneuburg Basin (helveticum)
 3. Road to Pyrawarth; Upper Tortonian near Kolbaredorf
 4. The Steinberg Fault near Pyrawarth
 5. Pyrawarth-Mastrebek; Steinberg and Zistersdorf
 6. Tertiary (Sarmatian)
 7. Niedersulz-Bohnerappersdorf
- B. *Tour* ~~Excursion~~ into Southern Vienna Basin and the Marginal Areas; by H. Kuepper
1. Leuchtenwarth
 2. Baden
 3. Peilstein
 4. Wiener-Neustadt gap - Eisenstadt
- C. *Tour* ~~Excursion~~ through the Alps
- I. Alpine Piedmont and Southern Edge of the Bohemian Massif, by F. Grill and L. Waldmann
1. Geological summary
 2. Vienna - St. Poelten

- 1 -

RESTRICTED

RESTRICTED

3. St. Poelten - Amstetten
 4. Amstetten - Linz
 5. Linz - Lambach
- II. Helveticum and Fysisch; by B. Frey
1. Geological summary
 2. Lambach - Gmunden
 3. Gmunden - Gmundner Mountain
 4. Gmunden - Enns valley
 5. Salzberg's quarry and Hasenbauer's museum in Gmunden
- III. Northern limestone Alps (between Traun and Salzach rivers)
1. The Salzkammergut; by J. Schädler. With a contribution by K. Medwenitsch
 - a) Origin of the name and history
 - b) Terrain
 - c) Summary of mountain structure
 - d) Gmunden - Tschl - Laufen
 - e) Laufen mine (Tschl salt mountain)
 - f) Laufen - Gosauhle
 - g) Hallstatt Mine (Hallstatt salt mountain) by K. Medwenitsch
 - h) Gosauhle - Gosau, by J. Schädler
 2. Gosau - Golling; by R. Floechinger
 3. Golling - Werfen; by K. Heissel
- IV. Graywacke zone of the Salzburg Alps; by K. Heissel
1. Type of rocks
 2. Tectonics
 3. Werfen - St. Johann im Pongau
 4. Liechtenstein gorge
 5. St. Johann - Lend

- 2 -

RESTRICTED

RESTRICTED

V. Tauern Inlier (Gastein - Mallnitz); by Ch. Exner, with a contribution by

S. Frey

1. Geological Summary
 2. Land - Bad Gastein
 3. Bad Gastein
 4. Stubner Joch Mt.
 5. Pechaus Mt. - Mining tunnel
 6. Railroad tunnel through the Lohc Tauern Mts.
 7. Surroundings of Mallnitz
 8. Mallnitz - Obervellach
 9. View toward the West from Obervellach; by S. Frey
 10. Glacier cover of the lake land near Kleindorf; by S. Frey
 11. Obervellach - Hoellbrücke; by Ch. Exner
- VI. Drau Valley; by H. Anderle; with a contribution by S. Frey

1. Geological summary
2. Hoellbrücke - Iselsbach
3. View of the Lienz Dolomites from Iselsberg Mt; by S. Frey

VII. Tauern Inlier (Grossglockner Highway); by S. Frey; with a contribution

by W. Heissel

1. Geological summary
 - a) Rocks and stratification
 - b) Basic characteristics of geological structure
 - c) On the metamorphosis of the Penninic and lower East Alpine rocks
2. Iselsberg Mt - Pasterze glacier
3. The Pasterze glacier; by W. Heissel

- 3 -

RESTRICTED

RESTRICTED

- h. Pasterze glacier - Zell am See; by S. Frey
 - a) Pasterze-Hochtor - Edelweispitze
 - b) View from Edelweispitze Mt.
 - c) Edelweispitze - Zell am See
- VIII. Graywacke zone of the Kitzbuehel Alps; by W. Heissel

Zell am See - Thurn Pass - Kitzbuehel - St. Johann in Tirol
- IX. The Tauerngebirge Range; by W. Heissel
 1. Geological summary
 2. St. Johann i.T. - Kufstein
- X. The Tertiary of the Lower Inn Valley; by W. Heissel
 1. Geological summary
 2. Kufstein - Haering - Gratzenberg near Voergl
- XI. The Inn Valley (Voergl - Innsbruck); by O. Schmidegg
 1. South side of the Inn valley (to the mouth of the Ziller valley)
 2. North side of the Inn valley (to the mouth of the Ziller valley)
 3. South side of the Inn valley (mouth of the Ziller valley to Innsbruck)
 4. North side of the Inn valley (mouth of the Ziller valley to Innsbruck)
- XII. Patscherkofel Mt. near Innsbruck; by O. Schmidegg
 1. Trip from Innsbruck to Patscherkofel Mt.
 2. Geological summary of the view from Patscherkofel Mt.
 - a) the Stubai and Gatztaler Alps
 - b) the Zillertaler Alps and their foothills
 - c) the North Tyrolean Limestone Alps

- E N D -

- 4 -

RESTRICTED

50X1-HUM

RESTRICTED
SECURITY INFORMATION

C I A

FOREIGN DOCUMENTS DIVISION

Oct 1951

50X1-HUM

Program of the Reconstruction and Centenary
Celebration of the Federal Geological Institute

Programm der Wiederaufbau - und Hundertjahrfeier der Geologischen
Bundesanstalt

[This report has not been edited
or prepared for publication]

RESTRICTED

Proj: 10070

RESTRICTED
PROGRAM OF THE RECONSTRUCTION AND CENTENARY
CELEBRATION OF THE FEDERAL GEOLOGICAL INSTITUTE

Vienna, June 1951

Summary of the Program:

Tuesday, 12 June : 9 AM: Opening Ceremonies, opening of exhibition
 3.30 PM: Unveiling of monument of E. Suess
 7 PM : Informal gathering at Hotel Kahlenberg

Wednesday, 13 June: 9 AM: Lectures on the practical geology of Austria

Thursday, 14 June : 9 AM: Lectures on Austrian geology problems

Friday, 15 June : ~~Excursions~~^{Tours} through the surroundings of Vienna

Saturday, 16 June : Morning: Guided tour at St. Stephen's Cathedral
 Afternoon: Closing concert at Rasumofsky Place (by special invitations)

Sunday, 17 June through Saturday, 23 June : ~~Excursions~~^{Tours} through the Alps.

Tuesday, 12 June 1951: Opening Ceremonies at the Federal Geological Institute,
 Vienna 3, Rasumofskygasse 23.

9 AM : Welcoming of the guests

9.15 : Minister Dr. F. Hurdes: Opening address

9.30 : Lecture by the Chief of the Institute, Dr. H. Kuepper: Geology in Austria of today.

10.15: Addresses

11.15: Honorary addresses

11.45: Opening of exhibition "Geological Publications in Austria since 1945"
 by Minister Dr. E. Kolb.

- 1 -

RESTRICTED

RESTRICTED

- 3.30 PM : Unveiling of the rebuilt monument of E. Suess. Short address by representatives of the City of Vienna, of the Geological Society, and the Federal Geological Institute
- 5.00 : Reception of the foreign guests and of the representatives of the Chairs of Geology of Austria by the honorary Mayor of Vienna, Dr. Koerner, in the Great Hall of the City Hall
- 7.00 : Informal gathering at the restaurant on the Kahlenberg mountain
- Wednesday, 13 June 1951:

Lectures on the practical geology of Austria

- 9.00 AM : Engr. K. Lechner: Results in the field of stones and earths
 Prof. Dr. W. E. Petrascheck: Carbonization, seismic waves, and folding force
 Prof. Dr. Waldmann: Old ferrillith mines in the northern Waldviertel
[Lower Austria]
 Dr. O. Schmidegg: The Hall salt deposit in the Karwendel Mts structure
- 3.00 PM : Dr. R. Grill: On the state of exploration of the Austrian Tertiary basins
 Prof. Dr. A. Till: Agriculture and forestry soil science in Austria
 Dr. A. Ruttner: The geology of the Lower Austrian and Burgenland coal deposits
 Prof. Dr. E. Hofmann: Paleobotany in the service of geology and mining science
- 7.00 PM : Special Meeting of the Geological Society
 Prof. Dr. O. Kuehn: The present state of knowledge of the paleontology of the Vienna Miocene
 Dr. H. Zapfo: *P*liopithecus findings from the Miocene fissure filling of Neudorf on the March River

- 2 -

RESTRICTED

RESTRICTED

Thursday, 14 June 1951

Lectures on Problems of Austrian Geology

9.00 AM : Prof. Dr. L. Kober: Atom structure and geology

Prof. Dr. K. Metz: Tectonics and metamorphosis in the Seckau greywacke zone

Prof. Dr. K. Mader: The gravitational measurements of the Federal

Bureau of Calibration and Measurements

Dr. Ch. Exner: Geological problems of the Hohe Tauern Mts.

3.00 PM : Prof. Dr. G. Gotszinger: Flysch

Dr. S. Prey: Flysch and Helveticum

Dr. Engr. G. Hieselsleitner: The Dinaric ophiolite line in the Eastern Alps

Dr. A. Thurner: The Murau Paleozoic

8.00 PM : Special Meeting of the Austrian Mineralogical Society, auditorium of
the Museum of Natural History:Technicolor movie: The Rise of the Volcano Paracutin in Mexico
(loaned by the Smithsonian Institution).

Friday, 15 June 1951

Choice of A) B) or C)

A) ~~Excursion~~ to the Northern Vienna Basin:

Vienna- Korneuburg Basin - Steinberg - Vienna

Guides: Dr. R. Grill, Dr. R. Janoschek

Buses leave 8 A.M., from Burg Theater, return 7 P.M.

B) ~~Excursion~~ to the Southern Vienna Basin:

Vienna- Peilstein - Wiener Neustadt - Eisenstadt

Reception by Government of Burgenland Province at Eisenstadt

Guide: Dr. H. Kuepper

Buses leave 8 A.M., from Burg Theater, return 9 P.M.

C) Functions of the Austrian Mineralogical Society (program in separate publications)

- 3 -

RESTRICTED

RESTRICTED

Saturday, 16 June 1951

Morning: Tour at St. Stephen's Cathedral

Geological Structures: Dr. A. Kisslinger

Terrain of Vienna: Dr. H. Kuepper

Meeting place: 9.30 AM, in front of ~~City~~ Portal of Cathedral

(Reservations required)

Afternoon: Closing concert at the Geological Institute (by separate invitation)

Sunday, 17 June to Saturday, 23 June: ~~Excursion~~ ^{Tour} through the Alps (for geological details see ~~excursion~~ ^{Tour} guide, under separate cover).

17 June: Vienna - Gmunden (departure 7 AM, from Burg Theater)- Overnight: Gmunden

18 June: Gmunden Gmunden

19 June: Gmunden - Hallstatt - Werfen Werfen

20 June: Werfen - Gastein - Mallnitz Mallnitz

21 June: Mallnitz - Franz-Josefs-Hohe Fr. J.-H.

22 June: Kitzbuehel - Kufstein Kufstein

23 June: Innsbruck - Patscherkofel Innsbruck

Details on Organization: Information available at the office of the Geological Institute from Dr. Woletz or Dr. Heissel

to June 12: For better scheduling, guests holding lectures are requested to make reservations for them by 9 June. For the guests of the Mayor, buses will be available for the trip from the Geological Institute to the City Hall, and from there to the Kahlenberg Mt., and for the return from there after 10 PM. All other participants are requested to use public transportation.

RESTRICTED

- to 15 June: The bus tickets will be issued at the information desk of the Institute on 13 June, fare 25.- S. Excursion guides will be issued with the tickets.
- to 16 June: Due to the very limited space available, this guided tour is restricted to foreign guests and the representatives of the Austrian Chairs of Geology. In case of sufficient interest, it will be repeated in the fall. Invitations for Saturday afternoon will be issued separately.
- to 17 June: ~~Excursion~~ ^{Trip} through the Alps: all information available at the information office of the Institute starting on 13 June, and at Hotel Austria in Gmunden starting at 4 PM on 17 June.

- E N D -

- 5 -

RESTRICTED

CONFIDENTIAL
RESTRICTED
SECURITY INFORMATION

carbon copy 2/2
(for files)
(thermoprint of figure)
[extra thermoprint of
the figure is included]

50X1-HUM

C I A
FOREIGN DOCUMENTS DIVISION

23 Oct 1951

50X1-HUM

Dynamic Stability of a Pendulum Attached to
An Oscillating Support

Journal of Experimental and Theoretical Physics; Volume 21,
No. 5, pages 588-597. Peter L. Kapitza, May 1951.

[This report has not been edited or prepared for publication.]

CONFIDENTIAL
RESTRICTED

RESTRICTED
CONFIDENTIAL

Proj: 10008

ON THE STABILITY OF A PENDULUM ATTACHED TO AN OSCILLATING SUPPORT

[Figures in the Appendix]

Peter L. Kapitza

Submitted 30 Oct 1950.

[Note: 1. The following report appeared in Zhurnal Eksperimental'noy i teoreticheskoy fiziki, Volume 21, No. 5 (May 1951), pages 580-597.

2. Another periodical, namely Uspekhi Fizicheskikh Nauk, Vol XLIV, No. 1 (May 1951), carries essentially the same article by the same author, except for a historical account discussing Galileo's work with the pendulum and different figures (reproduced in the Appendix).

3. An English-language work that considers the problem of a pendulum with oscillating support is a pamphlet entitled Elements of the Theory of Resonance Illustrated by the Motion of a Pendulum, by H. W. Brown, Sc.D., F.R.S; London: Cambridge University Press, 1932.]

ABSTRACT

The motion of a pendulum with oscillating support is studied under the following two conditions:

- 1) the amplitude a of oscillations of the support is small in comparison with the length of the pendulum l ;
- 2) the angular frequency of oscillations of the pendulum's support is large in comparison with the angular velocity of oscillations of the pendulum.

It is shown that the oscillations of the pendulum's support produce a moment of forces whose magnitude evidently is independent of the pendulum's period and length but is determined by the pendulum's mass and square of the velocity of oscillations of the support. This moment of forces is named vibrational moment, and tends to align the pendulum rod in the direction of the support's axis of

- 1 -

CONFIDENTIAL **RESTRICTED**

CONFIDENTIAL**RESTRICTED**

oscillations. It is shown that if we treat this vibrational moment as an ordinary force, the mechanical problems of motion involved in this type of pendulum are solved in a simple way; the accuracy of results is basically of the order of $O(\epsilon^2/l^2)$.

The conditions necessary for the realization of stability when the pendulum's center of gravity is above the point of support are found. The value of the vibrational moment is given for the case where the support executes non-harmonic oscillations. Equipment for demonstration of mechanical phenomena, produced by the action of the vibrational moment, is described. It is shown that vertical oscillations of the support with a period smaller than the pendulum's period of oscillations will always accelerate the movement of the clock. The problem concerning the possibility of observing the orientating effect of vibrational moment on colloidal particles and molecules is proposed.

As is well known, a) the most stable equilibrium of a motionless body corresponds to a position at which the body's center of gravity is located at its lowest point (corresponding to minimum potential energy); and b) the most stable dynamic equilibrium is the one where the center of gravity occupies its highest position (corresponding to maximum potential energy).

The ordinary gyroscope is the simplest illustration of this principle. As is known, the force produced by the friction of the gyroscope's support against the surface forces the gyroscope's axis to rise and to take the most vertical position; the precession of the gyroscope is damped and the gyroscope gives the impression of "dying away". Besides classical cases of dynamical stability, produced by gyroscopic forces, a number of other cases are discussed in the literature [1]. For example, it is pointed out that during fast motion of a

- 2 -

CONFIDENTIAL**RESTRICTED**

~~CONFIDENTIAL~~
RESTRICTED

man on stilts or bicycle, of an automobile, locomotive etc the greatest stability is achieved if the center of gravity has its highest possible position.

One of the best examples of dynamic stability is represented by a pendulum with oscillating point of support. The demonstration of this phenomenon is not less striking than that of a gyroscope and its study is equally instructive. However this case not only is little studied, but is usually not even mentioned in manuals or classical treatises on mechanics. In this work we shall give a simple and descriptive method for analyzing this phenomenon and we shall describe the equipment for its demonstration.

The essential phenomenon of this dynamic stability is reduced to the following.

A mathematical pendulum, of length l and with mass m , rotates freely at the point of support O , which support executes an oscillating motion along the y -axis, around the point A , with an angular frequency ω and amplitude a . If the y -axis is directed vertically upwards, as represented in Figure 1, then it is found that above a certain angular frequency ω_0 of oscillations, defined by the condition:

$$a^2 \omega^2 \geq 2gl, \quad (1)$$

the vertical position of the pendulum, as shown in Figure 1, is quite stable. This stability is well observed experimentally; for example, if we deflect the pendulum from its vertical position by a certain angle θ , then oscillations will occur around the vertical position, which are damped by friction, and after a certain time the pendulum will "die" in a vertical position.

The equation of motion of the pendulum represented in Figure 1, for small angles θ , lead to the expression (see derivation of expression (1))

$$\ddot{\theta} + (gl - a\omega^2 \sin^2 \omega t) \theta = 0, \quad (2)$$

- 3 -

~~CONFIDENTIAL~~
RESTRICTED

CONFIDENTIAL**RESTRICTED**

where g is the acceleration of gravity, and θ is the angle of deviation of the pendulum from the vertical. This is the equation of Mathieu. Solving it by the method of infinite determinants, Jeffereys [2] found an approximate periodical solution, by means of which he showed that if the amplitude a is small in comparison with the pendulum's length L , then the relation (1) is the condition for stability.

I assume that this method for solving equation (2) is effective for studying the oscillations of a pendulum which are produced by synchronous motion of the support (phenomenon of parametric resonance) [3]. For the study of stability, however, this method is not very suitable, because its result is limited by the case of a periodic state when angle θ is small; moreover, the matter is much more complicated as required by the problem under consideration. We shall show that the simple method of successive approximations gives a more complete and illustrative solution of this problem.

The peculiarities of the investigated motion of a pendulum with a rapidly oscillating support consist, first, in the fact that the support's angular frequency ω of oscillations is so high that during one period, $T = 2\pi\omega^{-1}$, of complete oscillation of the pendulum's support the angle θ will deviate but little from a certain average $\bar{\theta}$; therefore if

$$\theta = \bar{\theta} + \eta \quad (3)$$

then the angle η will be a periodical function of time, and its magnitude will remain small during the basic period T . The angle $\bar{\theta}$ may have arbitrary values, but it will vary but little during a period T . Secondly, in the investigated motion the amplitude a of oscillations of the support is small in comparison with the pendulum's length L . In the following we shall designate this ratio by ϵ ; then

- 4 -

CONFIDENTIAL**RESTRICTED**

**RESTRICTED
CONFIDENTIAL**

(h)

The study of the motion will show that the magnitude of θ characterizes the order of approximation of the results obtained.

These conditions imply that during the time T of one complete oscillation of the support the coordinates of the pendulum's mass m do not gain a relative increment greater than ϵ .

Such a character of the motion indicates that the method of successive approximations in powers of the quantity ϵ may be successfully applied. First we shall demonstrate this method by solving the familiar problem of the stability of a pendulum when angle θ is small.

For the solution of equation (2) let us assume the following initial conditions

$$\text{when } t = 0 \text{ then } \theta = \theta_0 \text{ and } \dot{\theta} = 0 \quad (5)$$

Then, in the first approximation, neglecting the value ϵ and integrating (2), we obtain

$$\theta = (1 + (1/2)gL^{-1}t^2 + \dots \sin \omega t) / \omega \quad (6)$$

for the second approximation we substitute this expression into (2) and obtain

$$\ddot{\theta} = (gL^{-1} - \dots 2\sin \omega t) (1 + (1/2)gL^{-1}t^2 + \dots \sin \omega t) / \omega \quad (7)$$

In order that the position be stable, it is sufficient that during the period T the increment of the angle θ should be equal to or less than zero; therefore

$$\int_0^T \ddot{\theta} dt = \dot{\theta}(T) - \dot{\theta}(0) \leq 0 \quad (8)$$

- 5 -

CONFIDENTIAL RESTRICTED

CONFIDENTIAL**RESTRICTED**

Substituting φ from expression (7) and performing the indicated integration of all terms, we obtain

$$(1/L)EL^{-1}\varphi^2 \left(1 - \frac{\alpha^2 \omega^2}{2g} L\right) \leq \dots \quad (9)$$

If the first two terms in the parentheses are equal, then the order of the following term will be of ω^2 , which is of small magnitude according to (4). In this way we obtain from expression (9) the desired relation (1) for stability with an accuracy of the order of ω^2 .

The method applied below enables us not only to solve the problem of stability of the considered pendulum with oscillating support, but also to compute its motion whether free or forced by exterior forces, without limiting the motion to small values of angle φ . As will be seen, this method of solving the problem enables us to conceive a simple notion of the physical significance of the process, because it shows that the oscillating motion of the pendulum's support leads to the creation of a moment of forces, which usually reveals itself as an ordinary force and is suggestive of gyroscopic forces.

Let us begin with the consideration of a mathematical pendulum and derive the equations of motion which are satisfied by any values of angle φ . Let us designate x and y the rectangular coordinates of the point, at which the pendulum's mass m is concentrated. Then we obtain from Figure 1

$$x = L \sin \vartheta; y = U + L \cos \vartheta \quad (10)$$

where U is the instantaneous value of the amplitude of oscillations of the point of support of the pendulum, depending on time in the following way:

$$U/L = (a/L) \cdot \sin^2 t = \alpha \cdot \sin^2 t \quad (11)$$

CONFIDENTIAL**RESTRICTED**

~~CONFIDENTIAL~~
RESTRICTED

We shall designate the components of forces acting along the coordinates x and y by F_x and F_y . Differentiating (10) we obtain the following equation of motion

$$\begin{aligned} F_x &= m\ddot{x} = mL(\ddot{\theta} \cos \theta - \dot{\theta}^2 \sin \theta) \\ F_y &= m\ddot{y} = m\sqrt{g} - L(\ddot{\theta} \sin \theta + \dot{\theta}^2 \cos \theta)Z \end{aligned} \quad (12)$$

The force couple acting on the pendulum will be

$$M_\theta = L(F_x \cos \theta - F_y \sin \theta) \quad (13)$$

Substituting the values (12) and (11) we finally obtain

$$M_\theta = mL^2(\ddot{\theta} + \alpha \omega^2 \sin \theta \sin \omega t) \quad (14)$$

Hence we obtain a nonlinear equation. If the moment M_θ is produced by gravity it is easy to prove that in the case of small values of the angle θ the equation (14) transforms into the already mentioned equation of Mathieu (2).

First we shall consider the problem of "static" equilibrium. By "static" equilibrium we mean the equilibrium under which a pendulum acted upon by an applied moment M_θ and by the dynamical forces produced by the oscillations of the support, executes oscillations around a certain value of angle θ . According to expression (3) we again assume that $\theta = \varphi + \beta$, where angle β is a periodic quantity of small amplitude and φ is a slowly varying quantity. In the considered problem of "static" equilibrium the value of angle φ will be constant. As long as β is small, then expanding $\sin(\varphi + \beta)$ in series in terms of β we obtain from (14)

$$\begin{aligned} M_\theta / mL^2 \omega^2 &= (\beta / \omega^2) + \alpha \sin \varphi \sin \omega t + \\ &+ \alpha \beta \cos \varphi \sin \omega t - (1/2)\beta^2 \alpha \cdot \sin \varphi \sin \omega t - (1/6)\beta^3 \alpha \cdot \cos \varphi \sin \omega t + \dots \end{aligned} \quad (15)$$

- 7 -

~~CONFIDENTIAL~~ RESTRICTED

CONFIDENTIAL**RESTRICTED**

Let us consider first the simple case where the externally applied moment $M_e = M_c$ is constant. Then we obtain from this expression as a first approximation of θ a value equal to

$$\theta_1 = \sin \omega t / \sin \omega t \quad (16)$$

In order to eliminate from our consideration forces that vary rapidly with the period of oscillation of the support, we shall average our expressions over the period T of one complete oscillation of the support.

The average for period T we shall designate by a dash; thus, for example, we have

$$\bar{M} = T^{-1} \int_{-T/2}^{T/2} M dt \quad (17)$$

As it is easily seen from (16), $\theta_1 = 0$ and $\dot{\theta} = \omega$ correspond to the mean time instant $t = 0$ according to the choice of such limits for the average. Substituting the value of θ_1 into (15) and taking the average, as long as on the left side we have the constant value $\bar{M}_c = M_c$, we obtain

$$\begin{aligned} M_c / m L^2 \omega^2 &= \omega^2 \cos \theta / \sin \theta \left[\sin^2 \omega t - (1/2) \cdot 3 \sin^3 \omega t / \sin^3 \omega t - \right. \\ &\quad \left. - (1/6) \omega^4 h \sin^3 \theta / \cos \theta \sin^4 \omega t + \dots \right] \quad (18) \end{aligned}$$

Taking into account the designation (h) we obtain

$$M_c = (1/h) m \omega^2 \sin^2 \theta \left[1 - O(\omega^2) \right] \quad (19)$$

It follows from (19) that up to values of the order $O(\omega^2)$ the constant moment of external forces M_c is in equilibrium with the moment equal to

$$\bar{M} = (1/h) m \omega^2 \sin^2 \theta \quad (20)$$

- 8 -

CONFIDENTIAL**RESTRICTED**

CONFIDENTIAL
RESTRICTED

It is seen from this basic expression that the oscillations of the pendulum's supporting point produce a dynamical moment, which we shall designate by vibrational moment" in the following pages. It has a simple physical meaning, as long as time does not enter in (20); $\bar{M}$ behaves just like the moment of ordinary forces that tend to set the pendulum rod along the direction of the support's axis of oscillation. The maximum value of the vibrational moment $\bar{M}$ is attained at $\dot{\varphi} = \dot{\varphi}_0$. It is also seen from (20) that the magnitude of the vibrational moment does not depend on the pendulum's length but is basically determined by the kinetic energy of oscillation of the pendulum's mass. In as much as for given amplitude a and angular frequency ω of oscillations of the pendulum considered, the moment is produced just as if by ordinary forces and varies only with angle φ , the mechanical problem poses simple physical significance and the relations reduce to finding the equilibrium of the vibrational moment $\bar{M}$ with the applied forces both static and inertial in nature.

More complex is to evaluate the order of approximation of the results obtained. As will be seen below, in ordinary problems on oscillating pendulums the accuracy of the vibrational moment $\bar{M}$ expressed in (20) is of the order $\alpha(\sqrt{2})$. As long as the magnitude α is the ratio a/L (ratio of amplitude a of oscillations of the pendulum's support to its length L), this magnitude is sufficiently small, in cases of interest to us, in order that the approximate value of the vibrational moment $\bar{M}$ fully and accurately depict the dynamical processes produced by the oscillations of the pendulum's support.

If necessary we may find the second approximation. For example, in the already discussed case of static equilibrium with $M_0 = \text{constant}$, the second

CONFIDENTIAL **RESTRICTED**

~~CONFIDENTIAL~~

RESTRICTED

approximation for β_2 is obtained from (15)

$$\beta_2 = \sin^2 t \sin^2 t = 1/16 \sin^2 2t \cos^2 t \quad (21)$$

Substituting this value of β_2 into (15) and averaging, we obtain the value H_0 with relative accuracy $O(\epsilon^4)$

$$H_0 = 1/4 \sin^2 2t \sin^2 t \left(1 - 3/16 \sin^2 2t \right) + O(\epsilon^4) \quad (22)$$

The next problem that we shall discuss will be the case of "static" equilibrium, in which H_0 is not constant but a function of angle θ . We shall introduce the designation

$$H_0 = H(\theta) \quad (23)$$

hence we obtain the following expansion

$$H_0 / \sin^2 2t = p + p' + 1/2 p'' + \dots \quad (24)$$

Substituting this value into (15) we obtain as the definition of quantity p the expansion

$$p = \left(\frac{1}{2} \right)^2 + \sin^2 t \sin^2 t + \left(\frac{1}{2} \right)^2 \cos^2 t \sin^2 t - p' - \left(\frac{1}{2} \right)^2 \sin^2 t \sin^2 t + \mu'' + \dots \quad (25)$$

In the first approximation we obtain

$$\beta_1 = \frac{1}{1 + p} \sin^2 t \sin^2 t \quad (26)$$

~~CONFIDENTIAL~~

RESTRICTED

~~CONFIDENTIAL~~ RESTRICTED

substituting this value in (25), averaging and making use of designations agreed upon in (25) and (20) we find

$$M_f = -\bar{M} (1 + p^2)^{-1} \quad (27)$$

In expression (23) the order of the value of $M_f / m\ell^2$ is that of the square of the angular velocity $\dot{\varphi}$, which the pendulum would acquire under action of the moment M_f . In expression (3) we limited our discussion of angle φ to cases in which the variation of angle φ is negligible during one period T of oscillation of the support; therefore the angular velocity of φ will always be less than angular velocity $\dot{\varphi}$. Hence in expression (23) the dimensionless values $p, p', p'', \dots$ are small in comparison with unity.

In the following exposition we shall limit ourselves to relative approximations of the order of $\varphi^2, p, p', p'', \dots$. Consequently this is the order of accuracy of expression (27) from which we obtain the previous value of the vibrational moment $\bar{M}$. Therefore we have the simple relation for any static equilibrium

$$M_f + \bar{M} = 0 \quad (28)$$

Let us consider as an example of "static" equilibrium the case in which the vibrational moment $\bar{M}$ is balanced by the force of gravity. Let us assume that the y-axis along which the support oscillates is inclined to the vertical by angle γ . Then if the pendulum rod makes an angle φ with the y-axis, the moment of the force of gravity will be

$$M_f = m\ell \cdot \sin(\varphi + \gamma) \quad (29)$$

From expressions (28) and (20) we obtain

$$h\ell \sin(\varphi + \gamma) - a^2 \omega^2 \sin 2\varphi = 0 \quad (20)$$

~~CONFIDENTIAL~~ RESTRICTED

CONFIDENTIAL RESTRICTED

This equation defines angle φ for a given l . If equilibrium is possible, we obtain four values for φ , of which two correspond to stable equilibrium and two to unstable. The limiting value of φ will be 45° . In the particular case where the y-axis is vertical - that is, $\beta = 0$ - we obtain from (30)

$$l = a; \cos \varphi = 2gl/a^2 \quad (31)$$

In this expression the angle φ defines the boundaries of the region within which the pendulum is stable in a reversed position. This expression enters the familiar condition of stability (1) more precise and wider.

From expression (29) and (30) we obtain

$$p = 1/4 \omega^2 \sin 2\varphi; \quad (32)$$

hence it follows that in the problem considered the values p, p', p'' in expression (23) are of the order of smallness of ω^2 . Therefore the value of the vibrational moment expressed in (20) possesses in this problem, according to (27), a relative accuracy of the order of ω^2 .

Let us pass now to the case of "dynamical" equilibrium, where the angle varies with time and the moment of inertia mL^2 has to be taken into consideration.

If we consider the vibrational moment $\bar{M}$ as a moment of ordinary forces, then in the case of "dynamical" equilibrium the equation of motion may be written formally by adding to the expression (26) of static equilibrium the moment of inertia:

$$mL^2 \ddot{\varphi} = M_1 + \bar{M} \quad (33)$$

after substituting the value of $\bar{M}$ from (20) the first integration of this equation will give

$$(\dot{\varphi}/\omega)^2 = (1/2 mL^2 \omega^2)^{-1} \int M_1 d\varphi + \text{const} \quad (34)$$

CONFIDENTIAL
RESTRICTED

Let us introduce the designation

$$\lambda_2 = \gamma / \omega \quad (35)$$

From (34) and (23) we obtain

$$\lambda_2 = \int_0^{2\pi} \sin^2 \gamma + \frac{1}{4} \gamma^2 \quad (36)$$

From which it follows that the value of λ_2 has the same order of smallness as μ and γ^2 .

$$\lambda_2 = o(\mu) + o(\gamma^2) \quad (37)$$

In order to evaluate the degree of approximation of expression (33) let us assume that during one period T of averaging the angle γ will not be constant but will vary:

$$\gamma = \gamma_0 + \gamma_1 \cos \omega t, \quad \gamma_0 \leq \gamma \leq \gamma_0 + \gamma_1, \quad \gamma_1 \leq \gamma_0 \quad (38)$$

We shall preserve the indices of γ only in the processes of averaging.

Therefore, using the expression (35) we find that angle θ equals

$$\theta = \gamma_0 + (\gamma_1 + \gamma_2 \cos \omega t); \quad -T/2 \leq t \leq T/2 \quad (39)$$

The term in parentheses for the time from $-T/2$ to $T/2$ is small in magnitude; therefore, just as in expression (25) we obtain an expansion

$$\begin{aligned} \mu &= (\gamma_0^2/2) + (\gamma_1^2/2) + \gamma_0 \gamma_1 \sin \gamma_0 \sin \omega t + (\gamma_1^2/2) (\cos \gamma_0 \sin \omega t - \mu') - \\ &- 1/2 (\gamma_1^2 + \gamma_2^2 \cos^2 \omega t) (\gamma_0 \sin \gamma_0 \sin \omega t + \mu') + \dots \end{aligned} \quad (40)$$

CONFIDENTIAL
RESTRICTED

CONFIDENTIAL
RESTRICTED

The first approximation of β_1 gives

$$\beta_1 = \frac{1}{\sqrt{1 + \mu^2}} \left[1 - \frac{1}{2} \mu^2 + \frac{3}{8} \mu^4 - \frac{5}{16} \mu^6 + \dots \right] \quad (h1)$$

Substituting β_1 into (h0) and averaging we obtain

$$\begin{aligned} \omega^2 / \omega_0^2 &= 1 - \frac{1}{2} \mu^2 + \frac{3}{8} \mu^4 - \frac{5}{16} \mu^6 + \dots \\ &+ \frac{1}{2} \mu^2 / \omega_0^2 = \omega^2 / \omega_0^2 = 1 - \frac{1}{2} \mu^2 + \frac{3}{8} \mu^4 - \frac{5}{16} \mu^6 + \dots \end{aligned} \quad (h2)$$

This expression takes into account the influence of the magnitude of μ on the accuracy of the vibrational moment $\bar{M}$ in the case of dynamical equilibrium. The expression (37) gives a relation among ω^2 , μ , ω_0^2 , from which it follows that in cases where ω^2 and μ are of the same order of smallness, the vibrational moment $\bar{M}$ in dynamical processes possesses a relative accuracy of the order of ω^2 .

As an example we shall solve the problem of oscillations in the presence of gravity.

Substituting the value (29) into (34) and performing the integration we obtain

$$(\dot{\varphi} / \omega_0)^2 = (1/2) \left[\varphi_0^2 - \varphi^2 \right] \quad (h3)$$

where φ_0 is the constant of integration. Further integration of this equation leads to elliptic functions and oscillatory motion around the angle of static equilibrium expressed in (30).

In the particular case in which $\varphi_0 = 0$, which occurs either when the oscillations are horizontal or when ω^2 is much bigger than g ; then the expression (h3) gives

$$(\dot{\varphi} / \omega_0)^2 = 1/2 \left[\cos^2 \varphi - \cos^2 \varphi_0 \right] \quad (h4)$$

- 14 -

CONFIDENTIAL **RESTRICTED**

CONFIDENTIAL
RESTRICTED

This simple oscillation equation leads to elliptic functions too. It is also seen from this expression that the ratio of the support's period of oscillations to the pendulum's period of oscillations, equal to λ^2 , is of the order of λ^2 .

In the particular case where $\lambda = a$ and $\lambda = 0$ and λ is small, we obtain from (33) the expression

(15)

In this as well as in the following expressions, the sign + is used if the center of gravity is below the support, and the sign - is used if the center of gravity is above the support. Equation (15) gives the harmonic motion, the period of which equals

(16)

The period of a conical pendulum is simply computed

(17)

This expression is correct also for big values of the angle λ . It is interesting to remark that if the vibrational moment $\bar{I}$ is much bigger than the moment of the gravitational force the period T does not depend on angle λ , and we have a simple relation

(18)

If the stability condition (30) is observed, the magnitude of the last expressions in parentheses is always smaller than unity. In the case of such a mode of motion we have λ^2 and, according to (32), μ , μ' , μ'' of the order

- 15 -

CONFIDENTIAL **RESTRICTED**

~~CONFIDENTIAL~~

RESTRICTED

of α^2 . Therefore in the various cases of static and dynamic character, the value of the vibrational moment $\bar{M}$ given by expression (20) will be determined with relative accuracy of the order of α^2/L^2 and hence the values of angular velocities and periods of oscillations will be computed with the same order of accuracy.

Applying the same method of analysis to the cases of a physical pendulum, we may show that the equation of its motion will be, by neglecting magnitudes of the order of $O(p^4)$, $O(p^4)$ and $O(\alpha^2)$,

$$I \ddot{\theta} + \frac{1}{2} m g L \sin 2\theta = 0 \quad (49)$$

where k is the radius of inertia. It may be seen from this expression that the vibrational moment of the physical pendulum is, by a factor $1 + (k^2/L^2)$, smaller than that of the mathematical pendulum. Therefore the expression of the vibrational moment will be

$$\bar{M} = -1/L (1 + k^2/L^2) - 1_{\text{ma}} \alpha^2 \sin 2\theta \quad (50)$$

It is also possible to find the value of the vibrational moment in the case where the pendulum's support executes periodic oscillations more complicated than those of harmonic motion. In this case, we use for amplitude θ the sum of harmonics

$$\theta = \sum a_n \sin(\omega_n t + \varphi_n) \quad (51)$$

instead of expression (11).

- 16 -

~~CONFIDENTIAL~~

RESTRICTED

CONFIDENTIAL
RESTRICTED

Then the fundamental equation of motion of the physical pendulum instead of (14) will be

$$M_0 = m(L^2 + k^2)\ddot{\alpha} + mgl \sin \alpha = \sum a_n \omega_n^2 \sin(\omega_n t + \sigma_n) \quad (52)$$

Solving the problem by the method described, we obtain the following expression for the vibrational moment

$$\bar{M} = -1/4(1 + k^2/L^2)^{-1} mgl \sin 2\varphi \sum \omega_n^2 \omega_n^2 \quad (53)$$

Substituting this value of $\bar{M}$ into expression (33), we obtain a more generalized equation of motion of the considered type of pendulum.

The vibrational moment $\bar{M}$ and the stability, which it produces, of a pendulum with an oscillating support are not less spectacularly demonstrated than the phenomenon of gyroscopic stability in a gyroscope. Although experiments with a pendulum with oscillating support are simple, they nevertheless involve difficulties greater than experiments with a gyroscope, because they require a special mechanism for forcing rapid oscillations on the support of the pendulum.

We achieved this with the aid of the simple equipment schematically represented in Figure 2. To the axis of a small high-speed electric motor 1 (we used the motor of a sewing machine) we fixed eccentrically a spherical bearing 2; and to the ball bearing we connected a pullrod 3, which sets into motion lever 4. One end of the lever rotates around a fixed support; to the other end the pendulum rod 5 is suspended in such a way as to swing freely. As shown in expression (31) the following values of the constants provide stability to the pendulum in the inverse position: For a pendulum of length $L = 15$ cm and a motor with number of rotations equal to 4000 to 6000, the

- 17 -

CONFIDENTIAL
RESTRICTED

CONFIDENTIAL**RESTRICTED**

amplitude a of oscillations of the point of support is between 3 and 4 mm. It is easy to find out that during such oscillations a considerable inertial load develops on the lever h . Therefore the lever h should be manufactured of the lightest and most durable material, e.g. duralumin. Within the pendulum rod s a considerable longitudinal strain of alternating signs develops, able to produce in it a longitudinal flexure and the phenomenon of resonance. Therefore we require a strong rod e.g. thick-walled pipe.

When the equipment starts operating, the pendulum rod behaves as if it were subjected to a particular force directed along the axis of oscillations of the support. As long as the frequency of oscillations of the support is high, the rod impresses on the eye a somewhat blurred picture and the oscillating motion is not noticeable. This is the reason why the stability phenomenon makes an unexpected impression. If a sideward push is imparted to the pendulum, it starts to swing like an ordinary pendulum with a period given by expression (16). These oscillations are damped and the pendulum eventually assumes a vertical position. If we incline the axis of oscillations of the pendulum's point of support at an angle β to the vertical, then under the action of gravity the pendulum will assume an inclined position of stability under the angle $\beta + \beta_0$ relative to the vertical, as derived in expression (30); and if the pendulum's mass is imparted a push, it will oscillate around this angle.

By imparting oscillations to the support of the pendulum, while it is suspended in the usual stable position, it is possible to observe the decrease of the periods of oscillations. If the period of free oscillations of a mathematical pendulum is T , then for an oscillating support the period

- 18 -

CONFIDENTIAL**RESTRICTED**

CONFIDENTIAL**RESTRICTED**

will decrease by decrement $\Delta\tau$, which is easily found from (46) to be

$$\Delta\tau/\tau_0 \approx -\frac{1}{2} \alpha^2 (\tau_0/r)^2 \quad (54)$$

This conclusion has practical importance in investigations of the causes that effect the accuracy of movement of pendulum clocks. Vertical oscillations of the base supporting the clock will produce oscillations of the point of support of the pendulum, and these will create the vibrational moment (53), which is added to that of the gravitational force and the clock will always move somewhat faster.

Therefore all vertical oscillations transmitted to a clock with a period shorter than that of the pendulum will always accelerate its movement. If we know the spectrum of oscillations (51) of the base of the clock, then applying the expression (53) to the vibrational moment we may compute in the same way as we derived expression (46) the small acceleration of the movement of the clock. It will be equal to

(55)

The inverse problem is possible as well; namely, to determine the average of seismic oscillations α_n^2 / r_n^2 during a certain time interval after measurement of a clock's movement. This study may be done by comparison of the movement of two similar clocks installed under identical conditions, except that one of them is isolated from ground oscillations and the other not.

At the beginning of our work we had remarked that the orientating moment of forces originating in oscillatory processes passed by unnoticed by the physicists; therefore it is of interest to widen this problem to a study of

CONFIDENTIAL**RESTRICTED**

CONFIDENTIAL
RESTRICTED

possible revelation of this effect in nature. If one end of an arbitrary particle, whether a colloid or even simply a molecule, executes rapid oscillations, a force couple is produced that originates in the vibrational moment $\bar{M}$, and is determined by expression (53). This force couple will tend to orient the major axis of the particle in the direction of oscillations. From expression (53) of the ellipse of inertia it may be seen that for sufficiently high frequencies of oscillations, even with small amplitudes, this force couple may be sufficiently large to produce essential changes in the particles' orientation. Among the physical processes most able to produce the necessary rapid oscillations for the appearance of this effect, we should afford first place to ultrasonic oscillations.

Submitted to the Editor

30 October 1950.

BIBLIOGRAPHY

1. G. Greenhill. Report on gyroscopic theory, London, 1914. Report and Memoranda No 146, Stationary Office.
2. H. and E. S. Jeffreys. Methods of Mathematical Physics, Cambridge, 1950 (second edition) 488 pp.
3. L. G. Loytsyanskiy and A. I. Iur'yc. Teoreticheskaya mekhanika (Theoretical Mechanics) Moscow, 1934, Pt III, 623 pp.

- 20 -

CONFIDENTIAL
RESTRICTED

APPENDIX

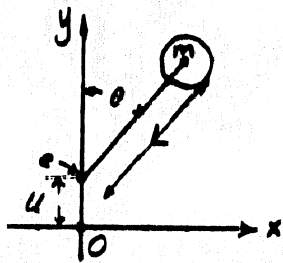


Figure 1 [source: Zhurnal]

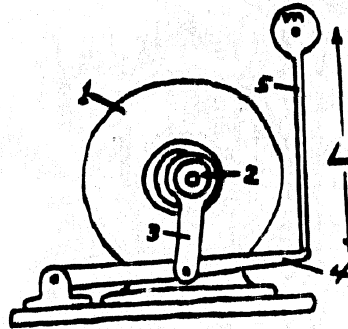


Figure 2 [source: Zhurnal]

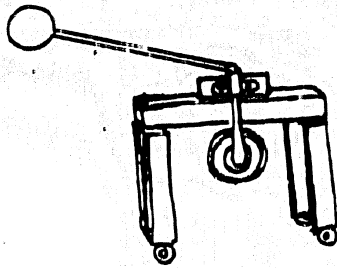


Figure 2a. Normal Position of the Pendulum. [source: Uspekhi]

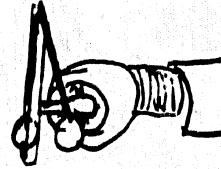


Figure 3a. Pendulum at Rest. [source: Uspekhi]

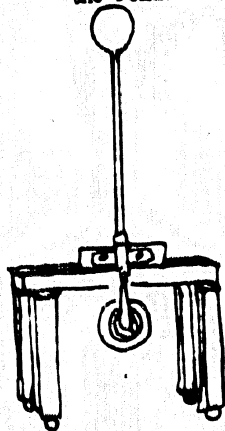


Figure 2b. Inverted Position of the Pendulum. [source: Uspekhi]

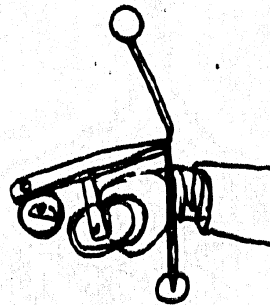


Figure 3b. Pendulum Vibrating. [source: Uspekhi]

ST 322

original copy

50X1-HUM

~~RESTRICTED~~
RESTRICTED

SECURITY INFORMATION
C I A

FOREIGN DOCUMENTS DIVISION

50X1-HUM

30 Oct 1951

Review of the Book 'The Physical Geography of Azerbaydzhan SSR'

Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva,
Volume 79, No 3, pages 359-361; E. Murzayev (reviewer);
Leningrad, May/June 1957.

[This report has not been edited
or prepared for publication.]

~~RESTRICTED~~
RESTRICTED

RESTRICTED

REVIEW OF THE BOOK 'THE PHYSICAL GEOGRAPHY OF AZERBAIDZHAN SSR'

E. M. Murzayev, Reviewer.

[Note: The following book review appeared in the journal *Investiya Vsesoyuznogo Geograficheskogo Obshchestva* (News of the All-Union Geographical Society), Volume 79, No 3 (May/Jun 1947), pages 359-361, in the regular Review section.]

The Physical Geography of Azerbaydzhan SSR. Under the editorship of Professor Mir-Ali Kashkay and Docent G. Alnev. Baku, 1945.
279 pages. 3,000 copies.

The Physical Geography of Azerbaydzhan SSR, written by a group of local scientific workers, was published in Baku. Work on it was begun much earlier in the Department of Economics and Geography of the Azerbaydzhan Affiliate of the Academy of Sciences USSR, but the book was not published until after the end of the war.

The appearance of a book ^{devoted} ~~dedicated~~ to the complete physical-geographical description of one of the Union republics is a rare one; therefore a geography on Azerbaydzhan ought to be welcomed in our time. And mention should be made of the activity of Azerbaydzhan geographers, for they are pioneers in this work.

The experience of preparing a number of physical-geographical descriptions for publication reveal the complications involved in both makeup and editing of a descriptive work of this kind. In the process of working, many methodological, program, stylistic, and other types of problems arise for the group of authors and the editors. The bases for dividing the republic into physical-geographical regions, the unity of the material in the individual chapters, the integration of the chapters with each other on the basis of geographical synthesis -- all this presents rather great difficulties. Therefore it is understandable that in recent times there has been much discussion among geographers as to how and by

RESTRICTED

what plan and from what aspect geographical descriptions of individual countries, republics, and regions ought to be written. We are in urgent need of such books offering current scientific information within the comprehension of the general reader. Unfortunately geographical literature of recent years is extremely lacking in such works.

The Azerbaydzhan geographers in this respect are leaders, and right after the end of the war they presented for the reader's attention a reliable, completely scientific work, a survey of which this review is concerned with.

We shall note below the essential defects of this book, some of which the writers and editors are of course well aware; they are now preparing a complete geography of Azerbaydzhan; in this they will include sections on the population and economy of the country in addition to the physical geography. It is necessary to emphasize that we are not considering the faults of the book in detail in order to lower the prestige of the collective authors and editors. Theirs was an enormous and painstaking job. Its completion required tenacity, persistence, and labor. We are sure that future publications of the Institute of Geography of the Academy of Sciences Azerbaydzhan SSR will be more thorough, and perhaps this book review itself, done by a reviewer who very much welcomes the publication of the book in Baku, will aid a little in that achievement.

The Physical Geography of Azerbaydzhan SSR consists of a forward, introduction (location, boundaries, territories), nine chapters concerned with various divisions of geography, a bibliography, and subject and geographical place-name indexes. The nine main

RESTRICTED

chapters comprise 91 percent of the total bulk of the book; the remaining 9 percent of the text consists of supplementary material. The main chapters are as follows: 1. "Orography" (8 percent of the bulk of the book); 2. "Geology, Mineral Resources, and Mineral Springs" (21 percent); 3. "Seismography" (2 percent); 4. "Climate" (15 percent); 5. "Hydrography" (13 percent); 6. "The Caspian Sea" (3 percent); 7. "Soils" (7 percent); 8. "Vegetation" (11 percent); 9. "The Animal Kingdom" (11 percent).

In considering the quantitative relationship among the individual chapters, mention must be made of the disproportionately large and, in places, difficult chapter on geology as compared with the bio-geographical section of the book. The chapter treating the Caspian Sea is very scant. The editors have included a short section on seismography, which, in view of conditions in Azerbaydzhan, is justified. But the lack of data on such interesting occurrences in Azerbaydzhan as contemporary and ancient glacial deposits is not at all justified. The geomorphology of a country such as the Azerbaydzhan Republic is especially interesting, because it has such varied relief, though in general it is mountainous (the maximum altitude is that of Bazar-dyuzy Mountain, 4,406 meters; the lowest point is the level of Caspian, 27 meters); however, the authors scrupulously avoid bringing in any data on geomorphology. In the chapter on orography written by the now deceased Professor A. F. Liyster, geomorphological features are either entirely lacking, or, where they do exist, they are treated so summarily that the reader can form no well-defined concept of the characteristic features of the relief of a region.

[rest of paragraph illegible]

As with orography, so with geography. Important material is

RESTRICTED

omitted from this textbook concerning paleogeography -- the history of the development of the Azerbaydzhan territory in the upper Tertiary and Quaternary periods, and these data are especially interesting if we take into account the fact that emergence of dry land in this country is closely bound up with the history of the Caspian, which has been rather fully studied. This information is easily obtained, since an essay on geology that includes descriptions of Quaternary deposits requires only a little additional material in order to clarify and explain questions on paleogeography.

Among structural defects must be included the poor integrating of individual chapters with each other; such integration is essential to any book that treats the physical geography of some country. The impression ^{of disjointedness} ~~discrepancies~~ on the part of the majority of chapters is readily apparent to the reader in almost every instance. Such sections of the book as "Vegetation" (where even the historical-botanical material is presented) and "Climate" are more aptly classified as geographical.

In this short review it is not feasible to make a detailed analysis of each chapter individually. We shall point out only that the chapter on climate makes interesting reading, but it contributes little factual material that might further the understanding of the climatic peculiarities of those regions which the author (Professor I. V. Figurovskiy) treats.

The chapter on the Caspian Sea by (Professor A. N. Mikhalevskiy) is very brief, dry, and descriptive, and in general does not satisfy the reader. There are no data included about those highly interesting problems connected with observations of the drop in the level of

RESTRICTED

the Caspian at the present time. Only one very general paragraph is devoted to the fluctuations of the level of this sea. Nothing is said about the influence that the Caspian waters wield on the natural conditions of Azerbaydzhan. The history of the Caspian Sea is neglected, its connection with the Black Sea or the Aral' Basin by means of the Uzboy is not mentioned, and no data on the endemic fauna of the Caspian is presented.

The chapters on soils (Professor V. P. Smirnov-Loginov), vegetation (L. I. Prilipko), and the animal kingdom (N. K. Vereshchagin) both in exposition and factual material bear a closer resemblance to geographical descriptions. Each of these authors in the beginning of his description divides Azerbaydzhan into many regions, and in essence gives a botanical-geographical, soils, and zoo-geographical distribution by regions. The number of regions and their nomenclature varies with each author. On principle it is difficult to object to this. But in a book which supposedly deals with geography, one would like to see a single physical-geographical breakdown of Azerbaydzhan by regions, together with which enumerations of biogeographical descriptions ought to be given. The difficulty of the work lies in this. I know that a large and comprehensive project devoted to the principles of the physical-geographical distribution of Azerbaydzhan by regions, with descriptions of these regions, is part of the present program of the Institute of Geography of the Azerbaydzhan Academy of Sciences (I. A. Ibrahimbeyli); the successful completion of this project will make a physical-geographical description of the country much easier.

RESTRICTED

RESTRICTED

Let us note some of the inexact formulations or unsupported statements. On page 54 data are presented that pertain to the heightened output of petroleum, but no figures are given as to oil output in the year preceding the war. In this instance the figures for 1940 would be most characteristic; they were published at the time.

On page 100 paleoclimate data are presented. The author states that in the present "steppe climate precipitations comprise in all 26 percent of the amount that once prevailed, and the rate of thermal turnover has increased 135 percent. In Malyy Kavkaz where formerly precipitations were close to those of Astara, today they comprise in all 50 percent, that is, they have decreased by half, and the rate of thermal turnover has increased." From where, on the basis of what computations were these statements derived and established? Since there are neither explanations nor references, the reader rightfully regards with doubt this possibly accurate statement made by a great authority on the climate of the Kavkaz and Zakavkaz.*

In conclusion let us point out that outwardly the book is well and unpretentiously assembled. It is annoying that the printing of the photographs is poor, and all of the numerous maps are somewhat carelessly reproduced, disfigured as they are with frequent blurs which make them hard to use.

On the whole the book is very useful. It contains much factual material, it is written with an understanding of our contemporary knowledge and ideas, and its publication has shown us that geographers

*[Transcaucasia]

RESTRICTED

in other of the Union republics ought not postpone work on geographical descriptions of their own territories. The experience of Azerbaydzhan ought to be instructive.

Preparing and publishing such a book as The Geography of Azerbaydzhan SSR is no small task. We must take note of the energy, great labor and ability of the principal editors of the book -- Professor Mir-Ali Kashkay and Docent G. B. Alnev, who devoted much effort and time to its publication.

~~Top Secret~~

E N D

- 7 -

RESTRICTED

A-2102

RESTRICTED
SECURITY INFORMATION

C I A

FOREIGN DOCUMENTS DIVISION

carbon copy 1/2
(for requester)
(contains photocopy
of figures)

50X1-HUM

30 Oct 1951

50X1-HUM

Certain Peculiarities of the Decomposition of
Complex Titanium-Tungsten Carbide.

Zhurnal Tekhnicheskoy Fiziki, Volume XX, pages
1167-1174; V. P. L'vovskaya and Ya. S. Umanitskiy;
Moscow, October 1950 (No 10).

[This report has not been edited
or prepared for publication.]

RESTRICTED

RESTRICTED

CERTAIN PECULIARITIES IN THE DECOMPOSITION
OF COMPLEX TITANIUM-TUNGSTEN CARBIDE *

V. P. L'vovskaya and Ya. S. Umanskiy

[Tables and Figure Legends are appended. Bracketed numbers throughout text refer to literature cited at end of text.]

AUTHORS' ABSTRACT: In this work the decomposition process of a supersaturated solid solution of tungsten monocarbide WC in titanium carbide TiC, was roentgenographically studied.

Mol'kov and Vikker [1] have established that at 1900 degrees Centigrade, titanium carbide TiC dissolves up to 50.5 mole percent of tungsten monocarbide WC. Umanskiy and Khudekel' [2] have substantiated the data of Mol'kov and Vikker, and have shown that with increasing temperature the solubility of WC in TiC increases to 75 mole percent at 2540 degrees, and decreases to 42 mole percent at 1500 degrees Centigrade. Since the atomic radius of tungsten, equal to $1.41 \text{ \AA}$, is smaller than the atomic radius of titanium ($1.45 \text{ \AA}$), the lattice periodicity of the solid solution decreases with an increase in the content of tungsten carbide. These investigators have also noted the dependence of the lattice periodicity of TiC on its carbon content [2]; they have studied the process of dissolution of WC in TiC and have established the fact that the amount of carbon in the titanium carbide affects the size of the lattice unit cell of the solid solution.

This effect is especially pronounced at low concentrations of WC in the solid solution and does not afford any indication as to the content of tungsten carbide in the solid solution from the lattice periodicity, since the processes of formation and of decomposition of the solid solution are accompanied by undeterminable alterations

* [Note: This report appeared in *Zhurnal Tekhnicheskoy Fiziki*, Volume XX, No. 10, October 1950, pages 1167-1174.]

RESTRICTED

in the content of bound carbon, nitrogen and oxygen.

In conducting the study of the decomposition process of the solid solution, we have assumed, therefore, that the amount of tungsten carbide which is eliminated from the solution under various conditions of calcination of the single-phase complex carbide can be ascertained on the basis of alterations of the absolute intensity of the solid solution lines, as determined by means of a standard substance being incorporated therein.

END OF AUTHOR'S ABSTRACT

RESTRICTED

RESTRICTED

[MAIN TEXT]

1. Experimental Conditions.

For use in the experiments, a single-phase complex carbide was prepared consisting of 17 percent by weight (40 mole percent) of TiC and 83 percent by weight (60 mole percent) of WC. This composition corresponds to the carbide portion of the prevailing titanium-tungsten hard alloys, utilized in finishing steel, and consequently the results of the investigation could be used in analyzing the technological process of producing these alloys.

The single-phase complex carbide was prepared by us from a mixture of powdered carbides of titanium and tungsten, as well as from a mixture of titanium dioxide, tungsten carbide, and carbon black. The mixtures were calcinated* at 2300 - 2350 degrees Centigrade, in a carbon furnace, in a current of hydrogen.

In the former case the complex carbide is obtained in the form of very strong, well sintered briquettes. Their comminution to a powder required considerable mechanical effort (shattering with a hammer, grinding in a mortar or in ball mills). In the second case the complex carbide was very soft, due to the large amount of gases evolved during the carbonization process; it was but slightly sintered and was easily ground to a powder upon being slightly compressed between the fingers. Its crystal grains were considerably smaller than those of the complex carbide obtained from the mixture of carbides, which is apparent from the roentgenograms obtained without rotating the specimens. It could be expected that deformation, as in the case of decompositions of solid solutions studied by other researchers, would accelerate the decomposition process [4,5]. To determine the effect of deformation, a portion of each batch of complex carbide was ground (1 hour in a mortar or 36 hours in a ball mill), while

*[calcined, roasted]

RESTRICTED

RESTRICTED

the remaining portion was left unground. Calcination of samples was conducted in a Tammann's furnace, in a stream of hydrogen at various temperatures and durations. Following calcination, 15 percent of pulverulent metallic tungsten (standard) was added to the samples.

The samples were mixed with the tungsten in glass test tubes filled with alcohol, and fastened to a disk of a special device which revolved on a horizontal axis at the rate of 40 RPM.

Under these conditions of mixing, any mechanical action on the powder that might induce deformation was completely excluded. As was shown by roentgenographic analysis, the mixing in test tubes for a period of 12 hours is sufficient to obtain a uniform mixture. Cylindrical samples for roentgenographic study were prepared from the powders thus obtained by extrusion through a thick-walled glass capillary, 0.9 millimeter in diameter.

The pictures were obtained from rotating samples in accordance with the Debye method. The first stage of the work was conducted using cobalt radiation, the second using that of copper.

The film was screened from the secondary titanium radiation by an aluminum foil, 0.05 millimeter thick. Time of exposure was selected in such a manner that the blackening of the lines did not exceed 0.3 absolute units, since it can be assumed that under these conditions the blackening of the lines is proportional to the intensity of the causative rays. Photometric evaluation of the roentgenograms was conducted using the recording Zeiss microphotometer with a 3-fold magnification. Photometrically evaluated were the lines (200) of the solid solution, and (110) of tungsten.

At any composition of the solid solution these lines do not

RESTRICTED

large with lines of various h^2 , and furthermore are located sufficiently close together to decrease the effect of various factors on the ratio of their intensities. The experimental data show that the total error in the determination of intensity by exposure and photometric evaluation did not exceed 5 percent of the measured value. Taking into consideration the complexity of interference phenomena in the scattering of x-ray by a mixture of WC crystals and crystals of the solid solution of WC in TiC, we have renounced the use of a graduation curve plotted on the basis of computed data. The graduation curve was plotted on the basis of results obtained on photometric evaluation of roentgenograms obtained by using specially prepared mixtures of WC crystals and crystals of the solid solution. Samples of mixtures were photographed using cobalt radiation, but inasmuch as some of the work was conducted using copper radiation, for the sake of comparison this radiation was used in the case of 3 of the samples (containing 30, 55 and 60 mole percent of WC, respectively, in the solid solution).

The graduation curve, plotted on the basis of results obtained by photometric evaluation of these roentgenograms, is shown in Figure 1. In this graph the axis of abscissas represents the ratio of intensity of line (200) of the solid solution ($I_{\text{paomb.}}$) to the intensity of line (110) of the standard - the tungsten powder (I_w). As is apparent from the graph, when the content of WC in the solution is of about 50 mole percent (these are approximately the compositions of the samples studied), an error in the determination of the WC content of the solid solution of approximately 1 mole percent corresponds to an error in the measurement of intensity equal to 5 percent.

2. Results of the Experiments.

On calcination of the unground complex carbide at 1600 degrees

* $\left[\frac{I_{\text{solution}}}{I_{\text{standard}}} \right]$

RESTRICTED

Centigrade, there occurs a certain increase in the intensity of the lines of the solid solution during the first 10-15 minutes of calcination, and this increased intensity is not altered in the course of a prolonged period of calcination (6 hours in our experiments). At the same time even calcination for a period of 55 hours did not result in the appearance of WC lines in the roentgenogram.

Results obtained on measuring the intensity of the lines are shown in Table 1 and in Figure 2. As a result of grinding the complex carbide, there is an increased intensity of the lines of non-calcinated solid solution (Table 2).

Figure 3 shows the microphotograms obtained on using samples 537 and 538.

Deformation appreciably accelerates the decomposition of the solid solution, which is apparent on comparing phase composition and changes in the intensity of the lines of the solid solution (Tables 1 and 3, and Figure 2).

The higher the temperature of calcination, the more rapid is the decomposition of the supersaturated solid solution, which leads to a colloidal equilibrium of the alloy.

In Figure 4 the curves are given which show changes in intensity of the lines of the solid solution in the course of calcination of complex carbide samples at various temperatures. It should be noted that during the first few minutes of calcination, any regular variation in the change of intensity of the lines of the solid solution is almost absent, and the higher the temperature the more brief is the duration of this period. Apparently this is due to the extinction effect.

On utilizing the curves shown in Figure 4, and the graduation

RESTRICTED

curve, one can determine the composition of the solid solution in the given samples of complex carbide at various stages of calcination (Table 4).

In the course of the investigation, the following observations were also made.

(1) The rate of decomposition is affected by the grain size of the initial solid solution and the degree of its supersaturation.

Thus, in the roentgenograms obtained from samples of unground complex carbide prepared from a mixture of $TiO_2 + WC + C$, and consisting of much smaller granules, the WC lines appear after 5 hours of calcination at 1800 degrees Centigrade; samples of concurrently calcinated, unground complex carbide prepared from $TiC + W$, having a considerably larger grain size, are found to be still in uniphase condition. This is further substantiated by the quantitative change in phase composition by alteration of line intensities. A sample of complex carbide from $TiO_2 + WC + C$, calcinated at 1600 degrees for 120 minutes contain 46 mole percent of dissolved WC (equilibrium concentration 45.5 mole percent), whereas a sample of complex carbide from $TiC + WC$, calcinated under the same conditions still contains 54.5 percent dissolved WC.

On calcination of undeformed samples of complex carbide of various composition (carbides prepared from $TiO_2 + WC + C$) it was found that samples consisting of 73 mole percent WC and 27 mole percent TiC become two-phased after 26 hours of heating at 1600 degrees Centigrade, while samples consisting of 60 mole percent WC and 40 mole percent TiC remain single-phased even following 55 hours of heating at the same temperature.

(2) In the process of separation of the second phase, there takes place grain comminution of the "mother liquor" solid solution.

RESTRICTED

Thus, for example, the crystals of a deformed sample of single-phase complex carbide had a size of 10-15 μ *. Following calcination at 1600 degrees Centigrade for 60 minutes of this sample the greatest portion of solid solution granules did not exceed 7-8 μ , and only isolated granules reached the size of 10 μ (Figures 5 and 6). Grain comminution of the mother liquor in the course of second phase separation is also readily apparent from roentgenograms obtained from non-rotated specimens.

3. Discussion of the Results.

It is known that usually the plastic deformation of crystalline bodies somewhat decreases the integrated magnitude of interference lines of the roentgenogram, due to the formation of crystal lattice distortions connected with the so-called "strains of the third kind." Only in those instances when the initial structure closely approximates the ideal, and the crystals have little plasticity, does the deformation increase the integral capacity, forming a mosaic structure, which decreases the extinction effect characteristic of roentgen rays diffraction in structurally perfect crystals.

Formation of mosaic structure, on comminution of the crystals of the solid solution of WC in TiC, is apparently the cause of the 50 percent increase in intensity of interference lines, which results from such a treatment.

It is necessary to assume, therefore, that the non-deformed crystals of the solid solution of WC in TiC, prepared by sintering a mixture of the two carbides, or a mixture of titanium dioxide, tungsten carbide and carbon black at a temperature of 2300 degrees Centigrade, which is close to the temperature of peritectic decomposition of tungsten carbide which is 2600 degrees Centigrade, have a structure, nearly perfect, with a very weakly developed mosaicity. Such a structure ex-

* [micron]

RESTRICTED

plains the fact that non-deformed crystals of a highly supersaturated solid solution having a composition of 60 mole percent WC and 40 mole percent TiC do not undergo any perceptible decomposition on 55 hours of calcination at 1600 degrees Centigrade and a three hour calcination at 1800 degrees Centigrade.

Only more prolonged calcination at 1800 degrees Centigrade (5 hours in our experiments) clearly indicated that WC lines appear in the roentgenograms.

In more highly supersaturated solid solutions (73.0 mole percent WC and 27 mole percent TiC) the decomposition proceeds more rapidly, and as early as 26 hours after calcination is begun at 1600 degrees Centigrade, WC lines appear on the roentgenograms.

Decomposition of solid WC in TiC up to equilibrium concentration at 1600 degrees Centigrade, equal approximately to 45 mole percent, must be accompanied by a volume increase, of that zone wherein the conversion has taken place, by about 1.5 percent (in the undecomposed solid solution each metallic atom occupies a volume equal to $19.75 \text{ \AA}^3$; in the solid solution at equilibrium this volume is $20.0 \text{ \AA}^3$; and in the monocarbide of tungsten, which has separated from the solution, it is of $20.4 \text{ \AA}^3$). Since the binding forces in carbides are exceedingly great, and consequently the moduli of elasticity are very great, such a deformation should result in the formation of huge internal stresses with a very great elastic energy (see computations of Konobeyevskiy, [6], Zakharova and Iashko [7], conducted in the case of analogous processes in metal alloys).

The necessity to perform a great amount of work against elasticity forces renders practically impossible a separation of WC crystals

RESTRICTED

RESTRICTED

within the undamaged areas of the lattice; the decomposition is possible only at the crystallite boundaries and the boundaries of the blocks of mosaic structure.

Decomposition along boundaries of granules and blocks is facilitated because of the fact that within these areas the crystal lattice is somewhat friable and formation of crystals of increased molar volume causes much less elastic strain here, and also because the critical size of the nucleus of the new phase is much smaller at the available partition surfaces than in the areas of undamaged critical lattice.

Geisler and Koller [37], who in 1946 had studied, by means of the electronic microscope, the structure of Duraluminum having sustained natural aging, show a microphotograph in which the second phase crystals form a network, which apparently coincides with the boundaries of the blocks of the mosaic structure. This is good substantiation of the hypothesis. Since the crystal lattice of the non-deformed solid solution of WC in TiC displays only very weakly developed mosaicity, the supersaturated solid solution is found to be most stable and practically does not undergo decomposition over 55 hours at 1600 degrees Centigrade and over 3 hours at 1800 degrees Centigrade.

However, the initial stage of the decomposition process occurs in these alloys also, and causes increased intensity of the lines in the roentgenogram. The minute crystals of WC, which separate along boundary lines of the large blocks forming the indistinct mosaic structure of the non-deformed solid solution, apparently somewhat break up these blocks, which results in the increased intensity of the interference lines of the solid solution due to a weakening of the extinction effect. Since the total surface of the mosaic structure blocks is

RESTRICTED

RESTRICTED

small in the non-deformed crystals, and is relatively little increased by the break up of the blocks on separation of the small WC crystals, while diffusion paths are extensive under these conditions of decomposition, the total mass of separated tungsten carbide is found to be insignificant, and its lines do not appear. The small WC crystals which separate on decomposition, must be very small so that there is very rapidly attained the colloidal equilibrium, which was discovered and studied by Konobeyevskiy in his well known work on the structure of aluminum alloys [9] (colloidal equilibrium was found by Kurdymov and Lysak [10] in the study of martensite transformation). It also stabilizes the supersaturated solid solution.

Comminution of samples of complex carbide, as previously stated, causes the break up of the mosaic structure blocks, which manifests itself in the pronounced increase of the intensity of the interference lines of the solid solution (the effect exceeds threefold the change in intensity resulting from calcination of undeformed samples). The aggregated surface of internal boundaries of partition is sharply increased, and decomposition is facilitated to such an extent that at 1350 degrees Centigrade it is practically completed within 2 hours.

It appears that complex carbide prepared in one stage from the mixture $TiO_2 + WC + \text{carbon black}$, possesses a less perfect structure than the complex carbide prepared from a mixture of two carbides $WC + TiC$. This fact may have the same effect on increased rate of decomposition as the aforementioned lesser grain size of the solid solution.

[END OF MAIN TEXT]

[Tables and Figures follow]

RESTRICTED

FIGURE LEGENDS

FIGURE 1: Graduation Curve

1 - Co-radiation; 2 - Cu-radiation

X Axis - mole percent WC in the solid solution

Y Axis - Intensity

FIGURE 2: Change in the intensity of line (200) of the complex carbide on calcination.

1 - unground carbide; 2 - ground carbide

(one hour in a mortar)

X Axis - Time of calcination, minutes

Y Axis - $\frac{I_{\text{solution}}}{I_W}$ FIGURE 3: Microphotometric curves obtained from roentgenograms of complex carbide prepared at 2300 degrees Centigrade.

a - unground sample; b - sample ground for one hour in a mortar. 1 - line W (110); 2 - line of the solid solution (200).

Legend under the curves

"Right"

"Left"

in both instances.7

FIGURE 4: Change in the intensity of line (200) of the complex carbide, ground for 36 hours in a ball mill, on calcination (Co-radiation).

X Axis - Time of calcination, minutes.

Y Axis - $\frac{I_{\text{solution}}}{I_W}$ FIGURE 5: Complex carbide prepared from the mixture TiC + WC at 2300 degrees Centigrade x 1500.

RESTRICTED

[Figure Legends Continued]

FIGURE 6: Complex carbide following calcination at 1600 degrees for one hour x 1800.

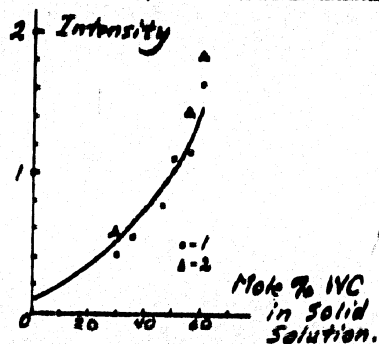


Figure 1. Graduation Curve.
1- Co-radiation
2- Cu-radiation

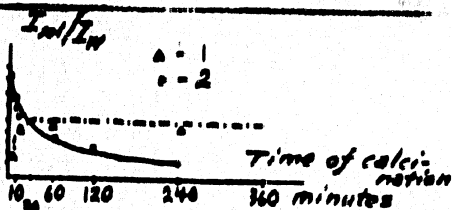


Figure 2. Variation in intensity of line (200) of complex carbide during calcination.

1- unground carbide.
2- ground carbide (one hour in mortar).

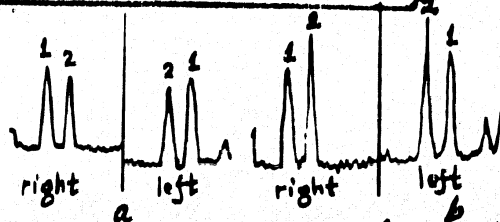


Figure 3. Microphotometric curves taken from roentgenograms of complex carbide prepared at 2300°C.
a: unground sample. b: sample ground for one hour.
1: line W (110). 2: line of solid solution (200).

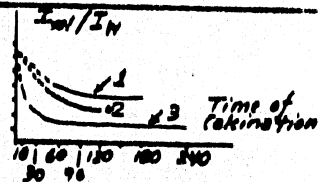


Figure 4. Variation in intensity of line (200) of complex carbide ground for 96 hours in a ball mill during calcination (Co-radiation).

1- $T^\circ = 1520^\circ\text{C}$
2- $T^\circ = 1600^\circ\text{C}$
3- $T^\circ = 1700^\circ\text{C}$



Figure 5. Complex carbide obtained from the mixture TiC + WC at 2300°C. X 1500.



Figure 6. Complex carbide after calcination at 1600°C for one hour. Magnification: 1500.

RESTRICTED

Figure Legends Continued

FIGURE 0: Complex carbide following calcination at 1800 degrees
for one hour x 1500.

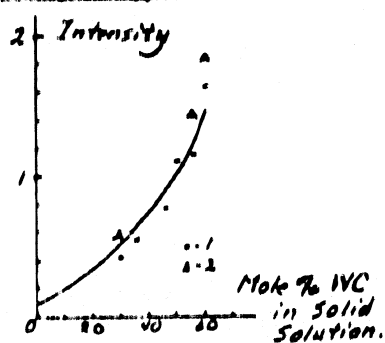


Figure 1 Graduation Curve.
1- Co-radiation
2- Cu-radiation

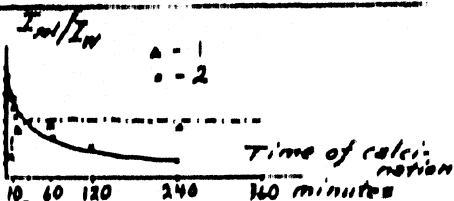


Figure 2. Variation in intensity of line (200) of complex carbide during calcination.
1- unground carbide.
2- ground carbide (one hour in mortar).

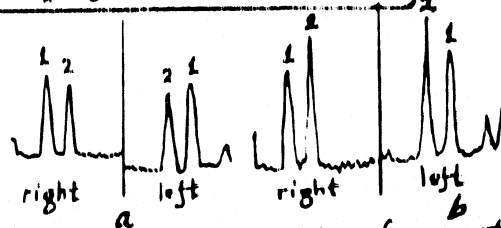


Figure 3. Microphotometric curves taken from roentgenograms of complex carbide prepared at 2300°C.
a: unground sample. b: sample ground for one hour.
1: line IV (110). 2: line of solid solution (200).

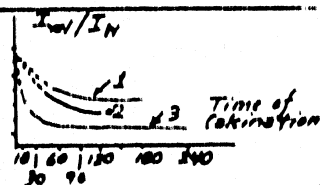


Figure 4. Variation in intensity of line (200) of complex carbide ground for 16 hours in a ball mill during calcination (Co-radiation)
1- $t^\circ = 1520^\circ\text{C}$
2- $t^\circ = 1600^\circ\text{C}$
3- $t^\circ = 1700^\circ\text{C}$



Figure 5. Complex carbide obtained from the mixture $\text{TiC} + \text{WC}$ at 2300°C . X 1500.



Figure 6. Complex carbide after calcination at 1600°C for one hour. Magnification: 1500.

RESTRICTED

TABLE 1

Change in the intensity of the lines of solid solution
(complex carbide from $\text{TiO}_2 + \text{WC} + \text{C}$; calcination at 1600 degrees
Centigrade; Cu-radiation).

No of Sample	Time of Calcination Minutes	$K = \frac{I \text{ solution}}{I}$	Phase Composition
1	Not Calcinated	0.85	Only lines of solid solution.
2	5	0.85	Only lines of solid solution.
3	10	0.97	Only lines of solid solution.
4	15	0.97	Only lines of solid solution.
5	30	1.09	Only lines of solid solution.
6	60	0.99	Only lines of solid solution.
7	120	1.03	Only lines of solid solution.
8	240	0.98	Only lines of solid solution.
9	360	0.99	Only lines of solid solution.
12	55 hours	Not determined	Only lines of solid solution.

RESTRICTED

TABLE 2Complex carbide from $TiO_2 + WC + C$; α -radiation.

No of Sample	Deformation	$K = \frac{I_{\text{solution}}}{I_W}$
527	Unground	0.86
537	Unground	0.85
528	Ground in Mortar 1 hour	1.35
538	Ground in Mortar 1 hour	1.28

TABLE 3

No of Sample	Deformation	Conditions of Calcination		Phase Composition	Remarks
		T° C	Time Hours		
248	Unground	1800	2.5	One phase, lines of solid solution	
1403	Unground	1800	5	Two phases, weak WC lines	
244	Unground	1700	5	One phase	
12	Ground in mortar 1 hour	1600	1	Two phases, weak WC lines	A very weak WC line
14	Ground in mortar 1 hour	1350	2	Two phases, clear WC lines	appears after 15 minutes of calcination.

RESTRICTED

RESTRICTED

TABLE 4

Time of Calcination Minutes	Phase content in mole % at calcination temperature of						Remarks
	1700°C		1600°C		1520°C		
	<u>WC</u>	<u>TiO</u>	<u>WC</u>	<u>TiO</u>	<u>WC</u>	<u>TiO</u>	
10	55.7	44.3	56.5	41.5	59.0	41.0	In calculation on basis of graduation curve. It was assumed $\Delta \approx 85.10^{-5}$
15	55.0	45	58	42.0	58.8	41.2	
30	53.0	47	57	43.0	56.7	43.3	
60	52.0	48	55.5	44.5	56.7	43.3	
90	52.0	48	54.5	45.5	56.0	44.0	
120	52.0	48	54.2	45.7	55.8	44.2	
180	52.0	48	---	---	55.5	44.5	
Equilibrium Composition by Solubility Curve	48.0	52.0	45.5	54.5	44.0	56.0	

RESTRICTED

RESTRICTED

LITERATURE CITED

1. L. P. Mol'kov and I. V. Vikker, Vestnik Metallopramyshlennosti (Herald of Metal Industry) 8, 75, 1936.
2. Ya. S. Umanskiy and S. S. Khidkel', Zhurnal Fizicheskoi Khimii (Journal of Physical Chemistry) 15, 997, 1941.
3. Ya. S. Umanskiy and S. S. Khidkel', Zhurnal Fizicheskoi Khimii (Journal of Physical Chemistry) 17, 985, 1941.
4. S. T. Konobeyevskiy, Zhurnal Experimental' noi i Teoreticheskoi Fiziki (Journal of Experimental and Theoretical Physics) issue 11-12, 418, 1943.
Symposium "Rentgenografiya v primeneni k issledovaniyu materialov"
("Roentgenography in Application to the Study of Materials")
page 193.
5. Delinger, Zeitschrift für Metallkunde (Journal of Metallurgy) 27, 200, 1935.
6. S. T. Konobeyevskiy, Zhurnal Experimental' noi i Teoreticheskoi Fiziki (Journal of Physical Chemistry) 13, issue 11-12, 1943.
7. Zakharova and N. F. Lashko, Izvestiya. Academy of Sciences USSR Section of Technical Sciences No 7, 1946.
8. Geisler and Keller, Metal Technology, 13, No 7, 1946.
9. S. T. Konobeyevskiy, Zeitschrift für Physikalische Chemie 171, (Journal of Physical Chemistry) 25, 1934; Izvestiya, Academy of Sciences, USSR Section of Chemical Sciences, page 1210, 1937.
10. G. V. Kurdyumov and L. Lysak, Zhurnal Tekhnicheskoi Fiziki (Journal of Technical Physics) 16, 1307, 1946.

Received on June 27, 1949

- 17 - RESTRICTED

50X1-HUM

CONFIDENTIAL

50X1-HUM

17 Oct 1951

~~CONFIDENTIAL - SECURITY INFORMATION~~

Dr. Nathan Leites, Vol. 1, 11, Copenhagen, 1950

AF 65845

[This report has not been edited or prepared for publication.]

RESTRICTED

SECURITY INFORMATION

MAPPING. Copenhagen, Grønlands Bogen Vol. I, 1950.

The Beginning of Systematic Mapping.

A small Subcommittee for New Mapping and Geological Research of Greenland was established in 1926 within the Commission for Geological and Geographic Research of Greenland. There a project outline was drawn up, and thus a completely new era in the history of research in Greenland was opened.

Considering Danish conditions, a really big scientific task confronted the officials. The objective was to make a precise topographic map of the entire Greenland coast, from the outlying rocks to the innermost nunataks of the inland ice. The task proved overwhelming and even oppressive for the first men to be sent out; they were landed on an open coast together with their instruments, light equipment, and supplies. In front of them was the ocean and behind them hundreds of kilometers of apparently inaccessible mountain and glacier terrain. They were hardly encouraged by the Greenlanders who, based on a lifelong knowledge of the country, simply declared that the task was impossible. But all the same, success was achieved to a degree and extent beyond the dreams of the first specialists engaged in the task.

The project was assigned to the Topographic Section of the General Staff, headed by H.P. Johansen, and to the Danish Geodetic Survey (Den Danske Grædvaaling), under the direction of H.E. Mørlund. From its start, the assignment was carried out in collaboration with the Government of Greenland which, among other things, had to furnish the boats. As soon as the geodesists were well on their way, geologists were to follow. Since it was of special importance for geological research to start in the basalt area of Northwest Greenland, it was decided that the work begin with mapping operations on Disko Island.

On 4 June 1927, the first two small geodetic expeditions set out on board the motorship "Disko", belonging to the Government of Greenland. One of the expeditions -- sent out by the General Staff -- consisted of officers and civilians under the direction of P.O. Jørgensen. Its task was to start with triangulation work on Disko Island. The other expedition -- sent out by the Geodetic Survey -- was composed of 1 officer, 1 graduate student, and 1 mechanic; it was to go to Godthaab Fjord to make astronomic geodetic position determinations at a special station selected and provisionally surveyed as early as 1922 by P.E. Jensen. C.O.A. Gabel-Jørgensen was in charge of this expedition. Despite great initial difficulties, the summer work of both parties made good progress. Especially the General Staff team was beset by troubles, partly because of lack of shipping and partly because of the impossibility of finding a geodetic jumping-off base of sufficient size in and around Disko Bay. Subsequently, a smaller base was selected close to the town of Godhavn itself, and by surveying a suitable base-triangulation net, the distance between two points in the mountains to the north of Godhavn was newly determined. The Geodetic Survey team erected a small wooden observatory near the outcrop of Horns; from there, a long series of stellar observations for the determination of the geographic longitude, latitude, and azimuth of the station were conducted by means of a modern transit theodolite. For use in the determination of time, a big pendulum clock was taken along and hung up inside a "rock cavern" (built in 1922). Scientific radio and time signals from Europe were received by radio and registered.

This was Greenland's late start in modern mapping.

During the following year an important and decisive step for the continuation of the project was taken: The above-mentioned two surveying organizations were merged into the Geodetic Institute. The Institute was placed under the War Ministry with M.E. Hørlund

RESTRICTED

as its chief. Mapping of Greenland was continued under his direction.

Triangulation

In the following years, a long series of surveying expeditions to Greenland's west coast were conducted. Their primary task was to determine and survey a supporting system of points, the so-called first-order triangulation, as an absolutely certain basis for the planned topographic maps and surveys. From 1920 to 1931, the field work was directed by H.C.A. Gabel-Jensen, and from that time to the present by S.P. Chantalon.

First-order triangulation, as such, started in 1920. It originated from a system of points around Godhavn, then proceeding by triangles of increasing size over Disko Bay, continuing northward over Narsarsuaq Peninsula along the margin of the inland ice, along the Hanneq Fjord, then going east (eventually around through the district of Qaanaaq to Melville Bay, and reaching its northernmost point on Melville Island. In 1931, the net was extended from Disko Bay southward to Nerby Strø Fjord, which forms the administrative boundary between North and South Greenland.

It is not our intention to describe the details of the work year by year; but let us follow a triangulation team for a single day on one of the earlier trips. As a rule, a motorboat carried 5 men on board: 1 Danish boatman and 2 young Greenlanders as crew and 1 geodesist with 1 assistant as a landing party. At first, the course is set to the nearest settlement. There 6-8 drift Greenlanders are hired to help with the transport of materials and later with the building of large stone mounds. The next destination is the mountain. The trek might take a long time - big ice obstructions will often be encountered, but finally the destination is reached; the climb can begin. Hour after hour the team follows

RESTRICTED

in single file behind the leader, on a twisting path, each man carrying a knapsack containing instruments, supplies, tents, etc. A trained team is able to climb 400-500 meters per hour, varying with the nature of the terrain. Occasionally one passes by a snowfield, a frozen lake, or a torrential brook. In few places climbing skill is needed, for example, when a glacier road has to be used, or when one has to hold on with hands and feet. Frequently backtracking is necessary to find a more suitable route; but they have to go up, not up their ice.

And what a view when after many weary hours they reach the peak of the mountain! To the north and south stretches a limitless mountain landscape of peaks, snowfields, and glaciers, broken up by deep valleys and blue fjords. To the west lies the belt of rocky coastal islands and the limitless expanse of the ocean with its white icebergs. To the east lies a big white desert - the inland ice.

It is often cold up there, bitter cold and stormy, and after a while the men are wet from perspiration and snow. But the geodetic and his helpers put on their leather outfits, and the work begins. At first, the observer checks the terrain with his field glasses and makes notes of the station points he can find and then of the special points he considers it necessary to survey. This is called, in technical language, "taking the horizon". Subsequently, he selects the place where the instrument can be set up to best advantage and affixes by means of a stone drill and a bronze peg a small metal plate to the rock; the plate bears the mark of the Geodetic Institute. The instrument is set exactly over the center of this marker. Then the surveying to other station points and to the many mountain tops, terrain points, islands, and rocks, etc., begins. Again and again one hears the observer "call a number" and the recorder's careful repetition of every number. In the meantime,

in single file behind the leader, on a twisting path, each man carrying a rucksack containing instruments, supplies, tents, etc. A trained team is able to climb 400-500 meters per hour, varying with the nature of the terrain. Occasionally one passes by a snowfield, a frozen lake, or a torrential brook. In few places climbing skill is needed, for example, when a glacier road has to be used, or when one has to hold on with hands and feet. Frequently backtracking is necessary to find a more accessible route; but they have to go up, and up they go.

And what a view when after many weary hours they reach the peak of the mountain! To the north and south stretches a limitless mountain landscape of peaks, snowfields, and glaciers, broken up by deep valleys or "fjords". To the east lies the belt of rocky coastal islands and the limitless expanse of the ocean with its white icebergs. To the east lies a big white desert - the inland ice.

It is often cold up there, bitter cold and stormy, and after a while the men are wet from perspiration and snow. But the geodist and his helpers put on their leather outfits, and the work begins. At first, the observer checks the terrain with his field glasses and makes notes of the station points he can find and then of the special points he considers it necessary to survey. This is called, in technical language, "taking the horizon". Subsequently, he selects the place where the instrument can be set up to best advantage and affixes by means of a steel drill and a bronze peg a small metal plate to the rock; the plate bears the mark of the Geodetic Institute. The instrument is set exactly over the center of this marker. Then the surveying to other station points and to the many mountain tops, terrain points, islands, and rocks, etc., begins. Again and again one hears the observer "call a number" and the recorder's careful repetition of every number. In the meantime,

the Greenlanders collect stones for the construction of the large mound. Sharp, cold winds, alternating with swarms of bloodthirsty mosquitoes when there is no wind, make the many hours spent behind the instrument a veritable ordeal. But surveying must go on, and finally the work is completed; then everybody helps with the building of the stone mound. This often might take up to 6-8 hours, but the result is a really magnificent stone mound, 3 meters in diameter at the base and 4 meters in height, made to resist wind and weather for hundreds of years. Finally the descent can begin. As soon as the last man is on board, the course is set back to the settlement, where the Greenlanders are landed and paid off. Then the trip continues to the next settlement to take on a new crew of Greenlanders as helpers for the next mountain.

In North Greenland, during the summer, the sun is in the sky day and night, and during good weather periods the work went on around the clock. Work was hampered by fog and clouds. It often happened that during surveying operations clouds gathered so fast that the surveying parties could not descend and had to stay on the mountain. On other occasions, the layer of clouds remained so low that all prominent peaks were above the clouds; standing on such a mountain station, the surveyor was able to continue his work in bright sunlight. Again on other occasions, gusts of wind and storms came up; then the boat either had to hurry to the next harbor or to seek shelter until the storm subsided.

The first motor boats for mapping work were acquired during these years; all along the coast they are known as "the blue boats". All the boats, now numbering six, are equipped with a radio transmitting and receiving set and the largest ones, in addition, have a sonic depth finder.

Those were the pioneer years which ended in 1931.

During 1932-1933, the system of points was extended, and the first-order triangulation was continued southward to Fredrikstad in the Cape Farvel area. The assignment was given to the Institute's Geodetic Section II, which was led in the field by the section chief himself. After enough experience was gained, far more effort was spent on the project-- expeditions became larger, more ships were added, and where formerly one man alone reconnoitered all first-order stations, now many were assigned to the task; when an area was ready, the many observers were distributed to the stations and then were able to survey mutually for each other according to a preconceived plan. As aiming points, heliostats were used, the systems of wires of which could be arranged in such a way that a survey would be thrown exactly in the direction of the other points. Electric lamps were likewise used; they made it possible to survey during the night, which is of particular importance in South Greenland. By this means great accuracy was obtained, but the weather was often so poor that it took sometimes weeks and even months to get a single sight between two first-order stations. The different surveying teams lived in tents on the mountain tops so that they would be ready whenever the weather cleared up.

By means of a simple blinker system or by lamps, the observers were able to communicate with each other and, among other things, could advise each other when they were ready to measure in a certain direction. The complete main net consists of 73 first-order station points and extends from north to south over a distance of about 1,800 kilometers. The triangle sides measure on the average about 50 kilometers.

A first-order triangulation by itself is not sufficient for map-making purposes, because the interval between stations is too large. Many more points are needed, and therefore a great number of other station points (detail points) were surveyed and natural fixed points (mountain tops, terrain points, etc.) were surveyed from the first-order stations.

RESTRICTED

Furthermore, a long series of points was surveyed by the special "base method", whereby a series of natural fixed points, about 5 kilometers apart, was established from a trigonometric station and a nearby auxiliary station. This is of especial importance when aerial photography is used for map compilations: the surveyor has photostats with him on the mountain and is able to select and survey on the spot those points which he can identify with certainty on the photographs. All these detail points, numbering in the thousands, are based on first-order stations: this guarantees that no noticeable accumulation of errors takes place.

Base Line Measurements

Since the angular measurements alone determine the form of the triangulation net, special base line measurements had to be performed in order to determine the length of the triangle sides. A flat and uniform stretch of land, preferably several kilometers long, is selected for a geodetic base; then tripods (or driven-in pickets) are set up at intervals of 24 meters and in a straight line between the two terminal points of the base line. On their top, metal pegs are fixed on which marks are scratched in, indicating the particular point of measurement. All intervals between the metal pegs are carefully measured with a fine base wire 24 meters long and made especially for this purpose from a special alloy, beginning at one end of the base line and ending at the other. By adding all the measured sectors, the distance between the two terminals of the base line can be determined with an error of only a few millimeters per kilometer. This base then can be incorporated into a specially surveyed and computed triangulation net; this net is connected with one of the sides of the first-order triangles. This side then can be computed with considerable accuracy from the

RESTRICTED

base, and from that side all other sides of the first-order triangle can be computed. The unit of measurements is the international meter. The length of the measuring wire is checked before and after the trip against the "archive meter".

The accumulation of errors is noticeable over rather long distances, despite the many painstaking angular measurements; therefore, about every 200 kilometers, a new base must be reconnoitered and surveyed. The exact length of the base is carried over to the nearest triangle side, so that the whole net receives renewed strength by this kind of geodetic "blood transfusion". Several such bases, together with the corresponding base nets for the exact determination of the net's dimensions, have already been surveyed, but some of the surveying still has to be done; therefore, the final mathematical treatment of this voluminous scientific material is still left to the future.

The Astronomical Determination of positions

In order to determine triangulation points -- and at the same time the position of the whole triangulation net within the international system of longitude and latitudes -- astronomical determinations of longitude and latitudes were made at intervals of one first-order point. The longitude was determined by observation of the transits of the stars through the meridian in conjunction with radio recording of the international time signals. The latitude was ^{by} determined/the Horrebow-method (named after the Danish astronomer Horrebow, 1679-1764), and the instruments used were either transit instruments or universal instruments of the highest precision. In addition, an azimuth determination was always made, whereby the direction to a station was fixed in relation to the true south.

Over the years a large and exacting amount of both scientific and practical work was done, and during the winters of all these

years many teams of mathematicians were busy in the Geodetic Institute, converting by extensive computation, the many observations into the co-ordinates needed for map compilations. The work has not yet been completed; many angular measurements, as well as base measurements, astronomical determinations of positions, and gravitation measurements still have to be done before the project can be closed. But the basis for the topographic maps of considerable areas of the coast has been provided.

Map Compilation

Map compilation as such can start as soon as the area has been sufficiently covered with fixed points. Having succeeded in the summer of 1930 in surveying a base in Disko Fjord and in executing the necessary astronomical determinations of positions, the officials now computed and coordinated a large area of points during the winter 1930-31 and constructed points on the plane table. Systematic mapping could begin on that basis.

The first expedition of 8 men, under the direction of O.C. Jørgensen, was sent out in 1931. Work was started in the Jakobshavn District and extended both to the north and south in the following years, so that in 1937 the whole area from the southern boundary of Esqerunde District to 73° northern latitude (somewhat to the north of Upernavik) was completely surveyed.

In many ways it is impressive how the young topographers contributed during these first difficult years with their mapping skill and with their efforts in the struggle against unyielding nature. A surveying party consisted of 1 topographer and 2 or 3 Greenlanders as helpers. Starting out in the summer, the party worked its way up from the seashore into the mountains, like a snail on a slow winding trail. The team carried with it a plane

table on the white drawing paper of which appeared only points co-ordinated from triangulations. Besides the given points, all terrain features like shorelines, mountains, rivers, glaciers, sleigh routes, etc., were established by measurement. All these results of the plane table work were then corrected, drafted, supplied with names and reproduced at the Geodetic Institute. Everything had to be shown: every parcel of land which had been surveyed, from the rocks far out in the ocean to the margin of the icefields and even far inland to the very end of the mountains.

The map projection selected is a coniform (true angle) conical projection, comprising a total of 6 cones, each covering 3 degrees of latitude from 60° (Greenland) to 93° northern latitude. The latitudes 60°, 63°, 66°, 69°, 72°, 75°, 78°, 81° and 84° form the separation lines between the 3 cone belts, each of which touches with its outer line (60°, 63°, etc.) the theoretical earth surface, and each of which reaches its greatest vertical distance from the earth in the very junction point of the conical belts. All the longitudes are straight lines which meet at a point on the extended polar axis.

The scale of the published sheets is 1:250,000. The sheet border lines correspond to the degrees of latitude and longitude. Each sheet comprises an area of about 12,000 square kilometers; it extends from north to south over a full degree of latitude (about 111 kilometers), from east to west over somewhat more than 100 kilometers and is a little narrower on the top than on the bottom. The sheets are printed in the following colors: black, blue, light blue, green, and brown.

In 1947, special surveys for an exact detail map (scale 1:2,000) of the most important west coast settlements were started.

Aerial Photography

Photographs taken from the ground were, as a matter of course, used in the mapping of Greenland from the very beginning. The method was already then well known and proved. But new and unexpected help was obtained when by photography from the air a bird's eye view of the terrain became possible. Soon it became apparent that aerial photography meant nothing less than a revolution of cartography. From high altitude flights (most frequently 1,000 meters) a long series of oblique pictures of the terrain were taken. By following a special system, it was possible to cover the whole area from the coastal periphery to the inland ice. For drafting purposes, photographs were used which were taken in pairs and with such a degree of tilt that the horizon was included. If such a pair of photographs is placed in a special apparatus, it forms a stereogram which offers a plastic view of the terrain. After the terrain points, as shown on the pair of photographs, are brought into adjustment with the corresponding points on the drawing board (plane table) by a special procedure, the drafting of the terrain itself can begin. On this special contour picture, the terrain formations of valleys and hills are brought out plastically, and on it one can proceed over the country's surface, beginning from the coast and then riding -- e.g., at contour intervals of 50 meters -- to the highest point within the picture's area.

The work in the field consists of the following: 1) determination of points from the ground (unfortunately the geodesist's work on the mountains has not been made superfluous as yet - he still has to trot up and down the mountains) and 2) the taking of aerial photographs. They not only save work for the topographer in the field, but also reach all places, "climb" the most difficult peaks, "pass over" the most impassable glaciers - all that they do, while

one sits by the map drafting machine, the so-called "aero-cartograph". Greenland is now at our fingertips, section by section, on large rolls of film, filed in boxes. Corrections can be made, step by step, as fast as determinations of points from the ground (triangulation) furnish the needed bases.

The different drawings naturally have to be adjusted afterwards, because large overlaps exist from one pair of pictures to the other and from one series of photographs to the other; then the area is divided into map sheets, color and names are added, and finally reproductions are made in the normal way.

Aerial photography was introduced in East Greenland in 1922 during Knud Rasmussen's and Laura Koch's expedition, but since then the Geodetic Institute has flown photo missions over large areas and procured considerable material which will be evaluated in future years. The methods are consistently the same, but photographic techniques are developing rapidly. The accomplishments of aerial photography are miraculous; it furnishes maps of an accuracy which would have seemed impossible to the pioneers of Greenland's mapping.

Air-photogrammetric field activities were at first under the direction of A.B.C. Madsen and, after Madsen's death in Greenland in 1947, under J. Helk.

Work on photographic flying missions is manifold. During the first years ships were used as bases for planes, all of which were equipped to take off and land on the water. In later years, airports available in Greenland were used as bases. For the servicing of airplanes now starting from land bases, a larger crew of mechanics and helpers is needed. The modern camera is mounted to the side of the aircraft; it is electrically heated and can be set on automatic exposure of pictures, so that the pictures mutually and between pairs of pictures have the correct spacing.

At the base, photo-technicians are waiting for the exposed film rolls that have to be developed, indexed, etc. Finally, modern flying requires a comprehensive weather service. In short, plenty of work has to be attended to. How much has been done can perhaps best be illustrated by giving operational figures for 1948. At that time the flying section was composed of 32 persons and 5 aircraft (1 Flying Fortress and 4 Catalinas). During the summer, about 12,000 kilometers of aerial survey routes were flown and 14,000 individual pictures taken.

Airplanes now fly both from and to Denmark and carry besides flying personnel, several members of the geodetic expeditions.

Mapping of East Greenland

It is only too obvious that mapping in East Greenland must be treated separately. The natural conditions of East Greenland are so different from those on the west coast that mapping was bound to have a totally different character and had to be carried out in a completely different manner.

East Greenland owes its special appearance to the sea ice. A powerful stream of floating icefields blocks most of the coast during the larger part of the year and permits navigation only during the summer months, starting in July at the earliest. The sea ice bears so much cold that the melting of the inland ice is far behind by comparison with the west coast; therefore the margin of the inland ice is much nearer to the coast and even reaches the sea at many points. This applies especially to the southeast coast, where the only large snowfree areas are to be found in the vicinity of Angmagssalik.

The east coast is divided by the large fjord system of Scoresby Sound into Southeast Greenland and Northeast Greenland. Modern mapping for both areas will be described here more in detail.

Southeast Greenland. The almost 1,500 kilometer long coastal stretch from Cape Farvel to Scoresby Sound is rough and inhospitable. Steep mountain cliffs rise vertically out of the sea; there are no protective belts of rocky islands and not many good harbors. And furthermore, there is the ill-famed sea ice. But from early July on, there is so much "sheltered water" within the belt of sea ice, that it becomes possible to maneuver through with small boats. This has been the opportunity availed the expeditions: the sea ice forms a breakwater behind which one can work freely and quietly.

This opportunity was seized by the first pioneers: Grash, Hols, and Garde, and Andrup. Only a generation later was the southeast coast again made the object of scientific exploration. In 1931, Knud Rasmussen was the explorer. For several successive years Knud Rasmussen studied carefully the melting of the ice on the east coast. He observed that the mass of sea ice decreased considerably from year to year. He realized his long-cherished desire, to explore Southeast Greenland, on the 6th Thule-expedition, a motorboat trip from Julianashaab to Lagsnesalik and back during August and September. This first motorboat trip along the southeast coast was only a reconnaissance, a forerunner for the following two years of extensive scientific explorations which were named the 7th Thule-expedition.

The mission of the expedition was to make a thorough exploration of the area, with map making as its main objective. The Geodetic Institute, having been approached on the matter, G.C.A. Gabel-Jørgensen was assigned the task. He acted at the same time as second in command of the expedition. The expedition started out in June 1932 for Julianashaab and Ivigtut and continued from there by boat and ship to the east coast.

In 1932 the cartographic personnel consisted, in addition to the chief, of 3 naval officers, 1 radio-telegrapher, 2 boatmen, 1 mechanic, and 10 Greenlanders. Three small motorboats served as transport and, as something quite new, the Danish Navy supplied an airplane with Naval Lieutenant S. Rasmussen as first pilot in addition to 1 flyer and 2 naval mechanics, 2 army photographers, and 1 phototechnician from the Geodetic Institute. It was the task of the geodetic parties to establish the necessary system of points along the coast from Lindesnev Fjord to Ullvik. The air group had to photograph the same coastal area according to a plan worked out in detail by the Geodetic Institute.

The travel plan of the geodetic parties was to reach Timariarsuit, to start jointly with surveying work there; after working methods were established and practiced, one party was to work northward to Ullvik and the other southward to Lindesnev Fjord. Not more than 2½ months, at the most, were available for work; consecutive triangulation therefore was impossible. Different methods had to be used according to the stations to be surveyed. The geodesists had to determine the position of stations with such a degree of accuracy that they could serve as a base for all other point fixations. Points on the ground were fixed by astronomical measurements and then tied together either by triangulations or "polygonic lines". Starting out from the measured points, a series of natural fixed points was surveyed, and a good many terrain sketches were drawn. Furthermore, the base method of surveying was used. Moreover, from stations the elevations above sea level of which could be established with a high degree of accuracy, zenith distances to coastal points were measured (surveying with a vertical base); this was done to such a degree that large sections of the coastal periphery could be drawn consecutively.

By an extension to the west coast, the surveying work was co-incident with that, but it was sufficient for the purpose, i.e., to serve as a basis for a new series of scale 1:250,000. Despite many difficulties, the task was successfully completed. The four aircraft completed a total of 152 stations, determined from their start to the first fixed points and not less than 2,500 coastal points.

The aerial photo section was led by L. Harnussen. The airplane - a single-engine Delco-Locke flying boat, used the expedition's ship as a base. The flight altitude for photo missions was 4,000 meters, the interval between the two pairs of a pair was 2.5 kilometers and between the pairs of photographs 7.5 kilometers. Oblique pictures were taken with an 15° tilt. Unfortunately, not all of the negatives were good; a number of initial difficulties had to be overcome. About 450 pairs of photographs were taken, and a total of 10,000 kilometers was flown.

In 1923, the working area comprised land farther to the north or to the west up to Kangerdlugssuaq. The plan of the expedition was to gather the whole expedition in the center of the area, near Angarsalik, and then to start many trips along the coast during the summer. The geodetic parties departed on board the Government-owned ship for the west coast, to continue from there in motorboats around Cape Farvel to the assembly point.

The boat crews left already in April for Holstenborg and Ivigtut in order to ready the boats for the trip to Jallaneqash. The four geodeticists left in May for Ivigtut, but because of difficult ice conditions they had to land at Sallarsah, from which one of the motorboats brought them to Jallaneqash, while all the surveying instruments had to be transported by a later boat. This was only one of many delays. A number of motor failures and impassable ice fields near Hvidevej (Ford) delayed the arrival at Jallaneqash to 27 July. This poor ice, all the attention was turned to the task of surveying on many points that the aerial photo maps to be taken during the survey could be oriented. After working out in the Ameralik area, one party worked northward and another southward; one proceeded inland visiting the W. R. R. station and connecting the network of points around Ivigtut with the one area of Jallaneqash, which was surveyed by the Danish expedition in 1932.

Astronomical observations of local stars (by measurements to the sun) were not at supporting stations to a greater extent than in 1932, which resulted in better constructed triangulation systems. Furthermore, the scientific equipment used was, on the whole, much better than in 1932, which naturally influenced surveying favorably. Moreover, at most of the stations, extensive point fixations were made by means of the line method. For use in future computations, a long series of stereographs was taken and oriented from the ground by means of a special photo-theodolite. The two parties surveyed a total of 106 trigonometric stations, 135 natural fixed points, 1,115 photographic points, and 1,622 coastal points (with vertical base). Furthermore, 131 small bases were surveyed, complete astronomical position determinations were carried out at 31 station points, and 907 photographic plates were taken -- and all that during two summer months.

RESTRICTED

The same Heinkel airplane which was used in 1932 was shipped to Ivigtut and then flown to Angmagssalik, where it arrived on 22 July. The plan for photo missions generally followed the pattern of the preceding year. Most of the aerial photographs consisted of oblique pictures, taken from 1,000 meters' altitude. Furthermore, a good many vertical shots of special coastal island chains were taken. A total of 540 pairs of photographs of high quality was taken; the distance flown amounted to about 15,000 kilometers. Thirteen of the surveyed map sheets have been published.

Northeast Greenland.

The area from Scoresby Sound to Nordost Land is one of Greenland's, or even the world's, most desolate coastal areas, due to its remote location, severe cold, and the sea ice. Extraordinary credit goes to those who for undertaking and completing a modern 3-year expedition to Christian X Land for exploration of this deserted corner of the world.

Because of very difficult navigation conditions, winter stations had to be established, so that the surveying parties could use the ice-cover during the spring and autumn to pass around the mountainous coastal areas. The short navigation period from July to August was used by the expedition's ships to bring in new supplies, as well as new personnel, and to distribute personnel to the scientific stations.

On 16 June 1931, the expedition's two ships, S/S "Godthaab" and S/S "Gustav Holm", left Copenhagen and arrived after a long and difficult voyage through the sea ice at the expedition's area. Two main camps and three sub-stations with winter houses, supply depots, etc., were set up on land, and then the work was begun. The expedition had a comprehensive work program for the area from

RESTRICTED

Seceesty Sound to Germania Land (77° northern latitude). The aim was nothing less than the mapping of this area with the aid of aerial photography. In the following, we shall describe this mapping project:

In 1931, a cartographic party of three men, with T. Johansen as head, was sent out by the Geodetic Institute. This party, went into winter quarters and took part in all four years' surveying work. In 1932, an additional party of seven men, and in 1933, of ten geographers, under the direction of L. Frøling, joined the first party. The surveyers were distributed over the area; they went out from their base camps to cover the area in spring and in fall by means of dog teams, often joining forces with other scientific parties. During the summer, after the sea ice either broke up or drifted to the sea, small motorboats could be used as transport.

Throughout, the cartographic methods were the same as those described for the work on the southeast coast. The supporting trigonometric stations were fixed by astronomical position determinations, taken to the sun. For time determinations, a small radio apparatus was carried along on sleds, and an ordinary watch of good quality proved sufficient for time readings, because the "error" and "rate" of the watch always could be checked against the many good time signals nowadays broadcast 24 hours a day. The dimensions of the triangle sides were determined by measuring smaller bases, and from the survey stations both natural fixed and special photographic points were established (by the base method). This ambitious project was realized by cartographic teams on many extremely difficult and bold sled trips and in all sorts of weather. It is really amazing that everything turned out so well.

The photo missions were flown by two Heinkel airplanes, made available by the Navy air force. The flight personnel, mechanics, photographers, and photo-technicians were assigned to the job by the Navy, Army, and the Geodetic Institute. Altogether there were 11 men in 1932 and 11 men in 1933 under the direction of the flyer, H.V. Petersen. The expedition's ships served as bases for the airplanes which took off and landed on the water. On completely clear and cloudless days, the airplanes went up to fly over the easy and long oblique line missions laid out by the Geodetic Institute. Series after series of pairs of oblique pictures had to be taken. Photographic work proved to be very difficult in the open and somewhat unstable planes. The two pictures of a pair had to be "shot" at an interval of 1/5 seconds; then after a waiting time of 135 seconds, the second pair of photographs had to be taken, again at an interval of 1/5 seconds, and this went on hour after hour. At that time the speed of the planes was only 170 kilometers per hour. At an altitude of 4,000 meters it was bitter cold, and it must be remembered that all three men - pilot, radio operator, and photographer - were in the open cockpit of the plane. As was the case with the 7th Thule-expedition in 1932, the first summer's photographs left much room for improvement, but the 1933 photographs came out excellently, after defects of the camera and of the films had been corrected on the basis of experiences gained previously.

During the two summers, a coastal strip of about 600 kilometers in length and about 700 kilometers in width was photographed from the air. This was achieved in 116 hours of flying and without any kind of accident.

RESTRICTED

The three-year expedition lasted for three winters and four summers, so that the last of the cartographic teams returned from East Greenland only in the fall of 1934. The collation of the many survey results and the drafting of the area from the many aerial photographs was left to the care of the Geodetic Institute. The maps compiled in this way -- 15 in all -- have by now been published.

20 Years Later

20 Years have passed since the first large triangle was surveyed in Greenland -- twenty very eventful years for Greenland's map making. It is impossible to incorporate or stress in this short report the full contribution made by each individual expedition and the comprehensive geodetic work carried out during these years. This work was directed not only at creating new maps but also at exploring the magnetic and gravity conditions of the Greenland massive by purely scientific measurements of geodetic and geophysical nature.

The modern mapping of Greenland has rapidly and successfully grown since it first started in 1917. The world war brought a complete standstill, but the years from 1940-1945 were not lost. The rapid technological progress made during those years compensated for the complete stoppage of work in the field. During the war, not only did flying technique develop in a revolutionary way, but aerial photography likewise made big forward strides, thanks to the tremendous quantity of war maps photographed over invasion areas. This extraordinary technical progress suddenly became available for peacetime work and, among other things, was immediately used for map making in Greenland.

But also in another respect the war set the pace for developments in Greenland. The need for a new, more detailed type of map than the already-started 1:250,000 scale map became apparent in Greenland. The Geodetic Institute immediately took steps to satisfy this new need. That involved a new penetration of the old areas, both from the ground and from the air. New and modern aerial photography of the west coast was started, while at the same time geodesists started on the ground to establish supplemental points for the orientation of the many new aerial photographs. The new map is still in the preparatory stage, and its scale has not been determined yet.

Greenland's modern map making has kept up with the times and even races time in its rapid development. Today all hands are kept busier than ever. Map making is a quiet and peaceful occupation and as a science it is completely devoid of "publicity". Large-scale and costly expeditions started out quietly, year after year, and quietly they returned home. Map after map was conjured up from desert areas, and many of them were compiled with incredible effort, privation, and inclemency, in a constant struggle against nature in one of the most desolate and impassable regions of the world.

Cartographers do not find gold or four-legged fish. They do not appear in the big newspaper headlines, but what other science is able to convert its research and the full measure of work into something so generally understood as a map? A small technical masterpiece in colors, a piece of land from the end of the world for sale at only a few kroner.

A modern map is an amazing element of civilization, something fundamental for the development of a common civilization and likewise so indispensable for nautical charts and for all the sciences which turn to nature for results.

Modern and systematic mapping represents Denmark's strongest research effort in Greenland so far, and Denmark has outlined greater new tasks for the future.

RESTRICTED

THE SEAS AROUND GREENLAND. Copenhagen, Grønlands Bogen Vol. I, 1950.

INTRODUCTION

Greenland is closely tied to the sea - a natural consequence of the fact that the inland ice covers all of the interior of the country. Therefore, as a permanent abode for men, animals, and plants, only a relatively small coastal tract is left, which, moreover, is intersected by deep fjords and bays. From ancient times, the sea has been the best way of communication, and only during recent years and only to a certain degree has a shift to the airways taken place; but even in air traffic, except for a few branch routes, only planes which can operate from sea bases are used. The sea always has been the place where Greenlanders found their main support by sealing and fishing.

The part of the seas which in the above sense has been of importance to communications and the development of the people of Greenland is only a comparatively small belt of water around the land, so narrow, in fact, that it can be seen completely from a high mountain on the coast. Within this belt, conditions are far from uniform in all locations. On first sight, one attributes this to Greenland's location between the ice-cold Arctic Ocean to the north and the warmer Atlantic Ocean to the south. But closer analysis shows that one has to go beyond the coastal waters proper to find a solution for the problems of differing conditions. A real understanding requires a knowledge of the different masses of water filling the large outlying seas, all of which exert influence on Greenland through oceanic currents. In the following, therefore, the essentials of our present knowledge of the hydrographic peculiarities of these seas will be set forth in condensed form.

SOUNDINGS

Depths are of fundamental importance for the description of water areas. The most important sea contours are shown on the depth chart for

RESTRICTED

all waters surrounding Greenland. (p. 65). It was impossible to indicate on such a small-scale map the contour lines for lesser depths close to shore. Around all continents there is a rim of relatively low water where the depth increases off-shore more or less evenly up to 200-300 meters; then the profile of the floor drops more abruptly toward oceanic depths and levels off after the deep seas are reached. The low-water submarine plateau, which is located within the steep slope of the floor profile and the seaward edge of which, as a rule, lies close to the 1,000 meter contour line, is a direct submarine continuation of the continental lowlands and is called the continental shelf. The continental shelf may be intersected by deep suboceanic fjords and, in general, the submarine relief is as uneven as the coast above sea level.

In view of the difficulties encountered in penetrating the ice-filled Arctic Ocean, an amazing number of soundings have been taken since Fridtjof Nansen in 1893 set out for that, then completely unknown, area. Certainly, in relation to the Arctic Ocean's area of about 2½ million square kilometers, the soundings are only sparse, but nevertheless it appears that the depths of that ocean have been explored in their general outline. In the center of the Arctic Ocean is a basin of more than 3,000 meters' depth. In the vicinity of the Geographic North Pole is an apparently greater aggregate of areas with depths of more than 1,000 meters; there the greatest measured depth exceeds 5,182 meters (Sedov, 1939). The record depth in the Arctic Ocean so far is 5,110 meters (measured in 1927 by Wilkins, with a sonic depth finder) and is located outside that area, i.e., about 190 sea miles northwest of Point Barrow in Alaska. The deep seas of the Arctic Ocean extend quite close to the northern coast of Alaska and very close to the Nordost Rundingen in Greenland, whereas the relatively low coastal water above the continental shelf north of Siberia and up to Alaska's northwest coast is of considerable width. At about 80° northern latitude, between

the Nordost Runden and Spitsbergen, stretches a suboceanic ridge, the Hansen Ridge, above which the greatest depth is probably 1,750-2,000 meters and which separates the great oceanic depths of the Arctic Ocean from those of the Northern Sea. [The Northern Sea is defined later in the text as consisting of the Greenland Sea and the Norway Sea.]

The greatest depths in the Northern Sea are about 3,600 meters and are located to the north and south of Jan Mayen Island. The Northern Sea is closed off from the Atlantic Ocean by the submarine Wyville Thompson Ridge, which stretches from the Shetland-Orkney Islands past the Faroe Islands and Iceland to Greenland's east coast. In the Denmark Strait, the greatest depth above the ridge is only 1,160 meters and is located in a small winding channel about 90 sea miles off northwest Iceland to the west. Several submarine fjords lead from the east into East Greenland's continental shelf. Otherwise, the depths above the continental shelf are known only to a lesser degree, due to the fact that the sea is filled with ice; but, nevertheless, in several spots the existence of banks has been ascertained. The Northern Sea is a distinct unit, so far as depths are concerned. Nevertheless, it became necessary to subdivide the Northern Sea by a line from Spitsbergen across Jan Mayen Island to Iceland into a western part, the Greenland Sea, and an eastern part, the Norway Sea. This was necessitated by the large hydrographic differences of the two parts: The Greenland Sea is characterized by the cold oceanic current originating in the Arctic Ocean, while the Norway Sea is predominantly under the influence of the warmer Atlantic Ocean water.

In the Irminger Sea appears the northernmost spur of the West Atlantic deep sea; toward the east it is bounded by the Reykjanes Ridge. As in the Greenland Sea, the depths within the 1000-meter sea contour, along the coast of Greenland, decrease very rapidly to 300-400 meters.

In the area between Greenland and the Canadian Arctic lie two great depressions. One, farther south, is a continuation of the West Atlantic valley; the other, more to the north, is an isolated depression which extends from about 67° northern latitude to a point due south of Smith Sound. Between these deeps, stretching across the area's narrow section, is the Davis Strait, a submarine ridge above which the greatest depth is only about 675 meters.

As may be seen on the map, the deep water of more than 1,000 meters' depth does not extend into Smith Sound, where the southern section (between Cape Atholl and Cape Isabella) probably has maximum depths of not more than 650 meters. In the northern part of Smith Sound, the depths increase somewhat. Located in the Ingolf Bay and the Ival Sound, is an isolated deep with up to 950 meters of water. Off Cape Parry this deep probably continues for 10 or so sea miles southward along Steensby Land.

Located within the 1,000-meter sea-contour, along the coast of Greenland from Cape Wavvel to Cape York, are several banks of varying size. The most important, listed from the south up, are: Julianehaab Bank, Frederikshaab Bank, Danas Bank, Friskens Bank, Myllas Bank (off Godthaab), Lille Hellefiske Bank, Store Hellefiske Bank, the Disko Banks, and a series of banks from Upernavik to Cape York. The banks are separated from one another by rather deep channels which lead in toward shore. Around some of the banks occur rather deep waters while at others the low water continues all the way up to the shore.

CURRENTS

Before we continue with a description of the masses of water filling the seas around Greenland and of their currents, a few general remarks which will facilitate understanding are in order.

Samples of sea water of many different origins may appear to be completely identical, but it is possible to differentiate between them by their physical properties and their chemical composition, especially by their temperature and salinity. Salinity is expressed in per mil;

for example, 34.92 per mil salinity of a sample of water means that after evaporating 1 kilogram of a sample of water, the solids remaining after evaporation of all water particles will weigh 34.92 grams. The waters of the Atlantic Ocean have a relatively high temperature and salinity, while the Arctic waters are cold and have a lower salt content. As a rule, masses of water have several layers: The lighter ones are on the surface and the heavier ones on the floor. When two sea currents of different density meet, the heavier water flows beneath the lighter. Warm water is lighter than cold water of the same salinity. If a sea current or a mass of water is cooled for some reason, it will sink to a level where the surrounding water has the same density. If masses of water with the same temperature but with different salinity are compared, the one with the higher salinity will be heavier. The surface salinity of a mass of water may increase somewhat when ice forms: salt particles are separated from the water molecules and increase the quantity of salt in the water below the ice. An oceanic current in the Northern Hemisphere will be deflected to the right due to the rotation of the earth; the greater the velocity of the current, the stronger the deflection will be.

The Arctic Ocean is covered by a 100-125 meter-deep layer of the so-called Polar water. That water is blended in the Arctic Ocean itself from sea water flowing into the basin from the south and from fresh floodwater originating on the coasts of the Atlantic Ocean. The surface temperature varies with the seasons, but is often in the neighborhood of the freezing point of water. At a depth of 50-75 meters, on account of winter cooling, an overall temperature minimum of -1.7° to -1.9° is found. Lower down, the temperature increases and amounts to 0° at the lower margin of the layer. In summer, the surface water may be completely fresh, but only 1-2 meters below the ice the salinity is not less than 29 per mil and at the end of summer even 31.0 to 31.60 per mil.

Below the polar water is a layer of Atlantic Ocean water with positive temperatures; to the north of Siberia, it is 800 meters thick (lying between the depths of 100 and 900 meters, while toward the North

Pole its thickness decreases to 100 meters (lying between the depths of 250 and 650 meters).

The Atlantic Ocean water enters the basin from the south, flowing partly around the west coast of Spitzbergen and partly through the Barents Sea. In the Arctic Ocean the current curves eastward and follows the continental shelf off-shore, because during its journey the water spreads northward. The highest temperature and greatest salinity of the Atlantic Ocean layer (2° to 3° and 34.99 to 35.08 per mil) is found near the continental shelf, northeast of Spitzbergen.

Below the Atlantic Ocean layer is another layer with negative temperatures. There the temperature decreases to -0.23° to -0.27° at a depth of 2,500-3,000 meters and then and a rises a little to -0.63° to -0.65° at the bottom of the Arctic Ocean's great deep.

As a natural consequence of the inflow of Atlantic Ocean water from the south and of floodwater from the coasts, corresponding quantities of water have to leave the area. This takes place by a slow but steady flow of surface polar water out of the Polar Basin. The major part of it moves toward the Greenland Sea; a smaller part flows into the seas between Greenland and Ellesmere Island and into the sounds between the islands of the Canadian Arctic Archipelago, while only minor quantities pass through the only 66-meter deep Bering Strait into the Pacific Ocean.

The Polar Current toward the Greenland Sea passes with its main body of water close by the Nordost Rundingen and continues, as can be seen on the map on p. 62, mainly in a southerly direction along the Greenland coast, where it is named the East Greenland Current. It has its greatest speed at its outer eastern section above the continental shelf's slope toward the deep sea. Observation data are lacking with respect to conditions in the northernmost (inner) section, located above the continental shelf to the north of Belgica Bank; probably one or several circular currents are located there, a branch of the main current toward Maelok Mountain; possibly, an unknown submarine fjord above the continental shelf is situated there. The most complete

knowledge about the current's course is available for the section between the Belgica Fjord and Kejsers Franz Joseph Fjord, where the largest number of observations have been made. A branch of the main current flows from the east into a submarine fjord between Store Koldevey Island and the Shannon Islands; one section of the current branches out northward along the east coast of Store Koldevey, other branches flow to the south, east, and west around Shannon, and, finally, a minor section flows northward into the Store Belt, west of Store Koldevey. The current which flows out from the Dove Bay passes close by the southern tip of Store Koldevey, then turns northward where it joins the above described northward current, and moves together with it past Germania Land northward to the Isle de France.

At about 74° northern latitude, the East Greenland Current has its first effluence to the east. Another branching off takes place at about 72° northern latitude in the extension of the Kejsers Franz Joseph Fjord. Other ramifications apparently take place off the Liverpool coast and the Scoresby Sound; they stream partly to the south and east around Jan Mayen Island and partly to the southeast and northeast around Iceland. The remaining main body of the current continues toward the southwest along the Greenland coast toward the Denmark Strait.

From the south, the Northern Sea brings in waters from the Atlantic Ocean; the main body passes through the Faroe and Shetland Islands and continues northward into the Northern Sea's eastern section, while a minor part branches out westward. After passing the continental shelf off Norway, the main body of the current flows toward the east into the Barents Sea; the rest continues toward the north along the west coast of Spitzbergen. The main body of the latter branch of the current, after passing Spitzbergen, flows beneath the lighter polar water and forms the positively temperatured intermediate layer in the Arctic Ocean. However, the westernmost section of the branch-current curves westward to the Nansen Ridge and to a confluence with the Polar Current west of Spitzbergen. There the Atlantic Ocean water likewise

flows beneath the polar water and continues together with it southward as an undercurrent. This current probably joins the eastward flowing branches of the polar water and penetrates into the submarine fjords to the west. After striking against the ridge in the Denmark Strait, the larger part of the remaining Atlantic Ocean water is deflected, and only a small part slips with the current into the Denmark Strait.

Another branch of the Atlantic Ocean water from the south reaches the Northern Sea west of Iceland as part of the so-called Liringer Current, then continues eastward, around the northern tip of Iceland, and then moves toward the south and southeast.

The Polar Current, which at its origin is calculated to have a temperature and a salinity of -1.85° and 34.60 per mil, becomes somewhat diluted on its way southward, but off Seereby Sound it still shows the following data: -1.40° and 34.20 per mil.

Between the Shetland and Faroe Islands the Atlantic Ocean water has the following temperature and salinity: 10.2° and 35.35 per mil; north of Lofoten the salinity is still above 35 per mil, and for the eastern part of the Mansen Ridge and in the northern part of the Atlantic undercurrent the following was ascertained: 2.10° to 2.15° and 34.97 to 35.00 per mil. On its way southward along East Greenland, the Atlantic Ocean water is strongly exposed to mixture with lighter and colder masses of water lying above it and to its sides. In the East Iceland Current, areas of mixed water of 0° to 2° and 34.75 to 34.90 respectively are found; they are the last remnants of the branch of Atlantic Ocean water deflected to the west near Spitzbergen.

The above-mentioned oceanic currents in the Northern Sea, the East Greenland Current and the Atlantic Ocean currents, for the most part stay close to areas along the continental shelf. The central part of the Northern Sea, i.e. 2/3 of that ocean, is filled with cold, rather homogeneous masses of water with very little current. This water

spreads from the center of the basin in all directions and beneath previously mentioned oceanic currents. To the north and northeast of Jan Mayen Island, this so-called central water almost reaches the surface, especially during winter. The formation of the central water takes place during winter when the mixed water in the upper layer of water of about 34.90 per mil salinity cools off to -1.3° to -1.4° or even lower temperatures, whereby it becomes heavy enough to sink to greater depths. When the cooled water has submerged below the surface, it will no longer be able to cool off, but will, on the contrary, increase a little in temperature because of the compression to which it is subjected in the lower layer of water. The water which has cooled off the most and therefore is the heaviest, sinks all the way to the floor. The coldest bottom water of the Northern Sea, with a temperature of -1.45° , is located in the very area of submerison, between 73° and 76° northern latitude. This bottom temperature is the lowest one observed on the floors of the world's deep seas, and therefore the northern part of the Northern Sea must be considered the pole of maximum cold of the deep seas. From the area of submerison, the cooled-off water also spreads past the Nansen Ridge into the great depths of the Arctic Basin.

As we have explained above, one segment of the East Greenland Current reaches past the ridge into the Denmark Strait and continues close to the coast somewhat to the southwest. The remainder of this segment is forced outward and can be located as far out as the channel above the ridge, where it mixes the upper 200-300 meters of water. After passing over the ridge, this latter, fairly heavy water moves beneath the warmer Atlantic Ocean water flowing in from the south.

The Irminger Current, a branch of the eastward-moving current in the North Atlantic Ocean ("The Gulf Stream"), curves toward the northwest toward Reykjanes and passes to the west of Iceland, then splits upon meeting the ridge and the southward-flowing East Greenland Current in the Denmark Strait. As previously mentioned, part of it continues to the

RESTRICTED

north of Iceland, while the remainder is at first deflected toward the west and later toward the south. During its course southward, it forces the water from the original East Greenland Current steadily closer to the Greenland coast. The boundary between the Irminger Current and the cold Polar Current is located approximately above the margin of the continental shelf along Southeast Greenland or a little inside the shelf. This boundary is not even, but has several curves caused by whirlpools, for which the unevenness of the sea bottom partly must be blamed; as a consequence, a fairly heavy mixing of the two kinds of water takes place. Because of the rather great extent of the Irminger Current, changes in the character of the stream affect the Polar Current to a very great degree. Off the southernmost section of east Greenland, the Irminger Current seems to send a branch toward the southeast; this branch continues later in the Irminger Sea as a clockwise-moving ("cyclonic") circular current. After passing Cape Farvel, the combined East Greenland Current -- the waters of the Polar Current and of the Irminger Current -- flows toward the west and continues inside the Labrador Sea.

Near Cape Farvel, the extent in depth of the Polar Current proper contracts to about 100 meters. The temperature minimum there is located at a depth of about 50 meters and amounts to about -0.64° . The salinity is 32.00 to 34.00 per mil. The Irminger Current, which before its branching out in the Denmark Strait had a temperature and salinity of 7° and 35.20 per mil respectively, near Cape Farvel at a depth of a couple of hundred meters has a temperature of 10° to 6° and a salinity of about 35.00 per mil.

The map on p. 71 showing the surface currents between Greenland and the Canadian Arctic, was compiled on the basis of data of the "Godthaab" and "Marion" expeditions, covering a period from the middle of July to the beginning of September 1928, and thus gives a picture of currents during that particular summer. In its broad aspects, this picture may be assumed to have validity for every summer, while in certain places the

details both with respect to the current's course and to its velocity might vary from year to year. For the area northeast of Baffin Island, observations necessary for the clarification of currents still are lacking.

On the map one immediately notices a northward-flowing current, streaming along West Greenland from Cape Farvel past Cape Alexander, which is most distinctly shown in the southwest sector of the country-- the so-called West Greenland Current. To the west of the same area, the southward-flowing Baffin Current is shown; it is formed by currents from Smith Sound, Jones Sound, and Lancaster Sound, and continues after passing the ridge in the Davis Strait under the name of the Labrador Current. In the following, each of these two main currents will be dealt with separately. Before doing that, the following should be mentioned: In the influx of waters, shown on the map as entering the area from the outside, must be added considerable quantities of water from the coast derived during the summer from the melting of ice, which both toward the north, along Greenland, and toward the south, along the Canadian coast, increase the coastal currents during the melting period on land.

The West Greenland Current. After passing Cape Farvel, the remainder of the Polar Current continues, together with the Iringer Stream, along the west coast of Greenland. While passing over the uneven sea bottom to the south of the region where the currents form several whirlpools, a fairly heavy mixing of the two masses of water takes place. Since there the cold current is weaker than the warm current, even more so than off Southeast Greenland, the character of the Polar Current suffers considerably. North of the Syllas Bank, at the height of Godthaab, it becomes extremely difficult to distinguish the different masses of water, and the joint current assumes Atlantic character to a very large degree.

One notices on the map that at the surface the West Greenland Current has already begun to branch out westward at the height of

Frederikshaab. This branching out continues during the current's course northward and is especially strong off Godthaab, where it meets the large fishing banks. The course of the West Greenland Current is by no means uniform. The variations to which its sources, the East Greenland Current and the Labrador Current are subject, both separately and in relation to each other, continue in the West Greenland Current. They appear as changes in its speed, width, water temperature, and salinity, as well as in its direction, in which connection the latter characteristic seems to be most recognizable in the outer section of the current's belt. It was found that in some years the first branching off occurred right after passing Cape Farvel. In general, it can be said that the speed of the West Greenland Current decreases with its distance from land. From south, the speed of the current increases in the direction of the current up to the height of Arck Fjord (this is caused by the addition of waters from the central part of the Labrador Sea); as a consequence of the current's branching out to the west, the speed of the current continues thereafter to decrease, noticeably further to the north in the main sector of the current. North of Holstenborg, the current is weak and can be located only quite far out from the coast, while only little of the water reaches the mouth of Disko Bay. As will be shown later on, a considerable part of the original West Greenland Current makes its way into Baffin Bay and the deeper layer of water above the ridge.

During the spring, no important current from the west is noticeable inside Disko Bay: the surface current of the West Greenland Current appears to continue to the north outside the bay's mouth. In the beginning of June, i.e. shortly after the melting of the fringe of the winter-ice, a weak (clockwise) cyclonic current is felt in the Disko Bay. Gradually, with the progress of summer, the cyclonic current becomes stronger; a weak eastward-moving current from the channel west of the bay becomes perceptible from the south side of the bay, and at the same time

a current moving westward past Godhavn is increased. At the end of August, the current moving into the bay increases and covers the width of the seaway from Egedesbade to the Parry rocks; the main part of the current flows toward the northeast and continues through the Vajest Strait, while a branch curves westward along the southern coast of Disko Island. At the end of the melting period on land, the coastal current in the area south of Disko Bay and simultaneously the current flowing into the bay itself probably are weakened.

North of Disko Island, the northward coastal current moves along the coast past Upernivik; one branch of the current continues to Melville Bay, into and around several banks, then past Cape York northward into Smith Sound, while another branch moves northwest and west to the north of Lancaster Sound. The northward-moving current in Smith Sound near Cape Alexander joins with the Polar current, which flows northward on the west coast of the sound. The surface current to the north of Disko Island has in the meantime completely lost its original Atlantic character by mixture with water from the melted coastal ice and snow and more correctly ought to be named there the Northwest Greenland Coastal Current.

Because of the mixing process to which the Larminger Current is exposed during its course north of Cape Farvel, a considerable part of its mixed mass of water sinks to greater depths. The warmest of that water, which near Cape Farvel is found at a depth of about 200 meters is south of the ridge at a depth of 500-700 meters. A considerable part of that water passes over the ridge into Baffin Bay and forms there a positively-temperated intermediate layer, which in the major part of the bay is located between the depths of about 400 and 1,000 meters. The influx of the warm water into Baffin Bay does not occur evenly throughout the year; during the spring, the deeper layer of water above the ridge seems to be fairly free of currents, and only

a current moving westward past Godhavn is increased. At the end of August, the current moving into the bay increases and covers the width of the seaway from Egedsund to the Farø rocks; the main part of the current flows toward the northeast and continues through the Vajøst Strait, while a branch curves westward along the northern coast of Disko Island. At the end of the melting period on land, the coastal current in the area south of Disko Bay and simultaneously the current flowing into the bay itself probably are weakened.

North of Disko Island, the northward coastal current moves along the coast east Upernivik; one branch of the current continues to Melville Bay, into and around several banks, then past Cape York northward into Smith Sound, while another branch moves northwest and west to the north of Lancaster Sound. The northward-moving current in Smith Sound near Cape Alexander joins with the Polar current, which flows southward on the west coast of the sound. The surface current to the north of Disko Island has in the meantime completely lost its original Atlantic character by mixture with water from the melted coastal ice and snow and more correctly ought to be named there the Northwest Greenland Coastal Current.

Because of the mixing process to which the L'Angeur Current is exposed during its course north of Cape Farvel, a considerable part of its mixed mass of water sinks to greater depths. The warmest of that water, which near Cape Farvel is found at a depth of about 200 meters is south of the ridge at a depth of 500-700 meters. A considerable part of that water passes over the ridge into Baffin Bay and forms there a positively-temperated intermediate layer, which in the major part of the bay is located between the depths of about 400 and 1,000 meters. The influx of the warm water into Baffin Bay does not occur evenly throughout the year; during the spring, the deeper layer of water above the ridge seems to be fairly free of currents, and only

later in the season is a noticeable current observed, while at the same time masses of warmer water are found at levels somewhat lower than before. The positively-temperated water does not penetrate into Smith Sound; on the other hand, a rather small part of it is found in the eastern sector of Lancaster Sound at a depth of 500-700 meters.

The testing of temperatures and salinity in this sector of the original Iminger Current has yielded the following set of data which furnishes information on the mixing and cooling process to which the current is exposed on its way through Baffin Bay: near the ridge off Holsteinshorn: about 2.65° and 34.67 per mil; in the southern sector of Baffin Bay: about 21° and 34.5 per mil; in the most central part of Baffin Bay: about 1° and 34.5 per mil; in the northern part of Baffin Bay: about 1° and 34.4 per mil; at the north of Lancaster Sound: 0.45° and 34.38 per mil. As can be seen from the above temperatures, "Warm" is a highly relative designation for these waters.

The Baffin and Labrador Currents. Between Greenland and Ellesmere Island, a cold current from the Arctic Ocean flows southward to Smith Sound, apparently filling the whole width of the sea to the north of it. The current, which afterwards stays close to the Canadian shore, receives the remnants of the Northwest Greenland Coastal Current and is supplemented furthermore on its way southward by a cold polar current from Jones Sound and Lancaster Sound. Off Lancaster Sound to the south, a branch of the current extends to the southeast and appears about 100 sea miles west of Upernavik, where it again turns southward toward Davis Strait. Apparently, the current formed in this way -- the so-called Baffin Current -- occupies the western 2/3 of the width of the sea between Upernavik and Baffin Island; currents in the western part have not yet been sufficiently explored, but most likely there exists one or several fairly large whirlpools between a branch of a current moving southward past Baffin Island and the above-mentioned eastern section of the Baffin Current. Off Upernavik, water from the eastern part of the Baffin Current spreads northward over the northern part of Baffin Bay. The water spreads partly on the surface and partly

beneath the lighter water in the Northwest Greenland Coastal Current.

To the north of Davis Strait, near the eastern side of the Paffin Current, are several large whirlpools, through which the Paffin water crosses into the eastern section of the seaway.

After passing the Davis Strait, the current gradually picks up the previously described large western branches of the West Greenland Current as well as the waters flowing out of the Hudson Strait; its speed increases considerably and in its changed form, it continues southward past the Newfoundland Banks under the name of the Labrador Current.

The larger part of the Labrador Sea's south-central part is filled with very homogeneously mixed water (essentially of Atlantic origin) in which currents are relatively weak and shifting. Between the depths of 1,000 and 2,500 meters, temperature varies only between about 3.2° and 3.05° and salinity between 34.87 per mil and 34.92 per mil. For that area, as well as for the one adjoining off Greenland to the south and the southeast, the following has been found: during winter and probably very irregularly, a special mass of water is formed by the cooling of surface water, which, because of its great density, sinks to the bottom; afterwards it slides southward to the greater depths of the Atlantic Ocean, where the so-called North Atlantic deep sea water, especially in the western sector of the ocean, continues extending toward the south above the still heavier northward-moving Atlantic floor current, which originates in the submergence area of the South Polar region. The North Atlantic deep sea current is, because of its high oxygen content, noticeable as far south as about 55° southern latitude, naturally in a very mixed form.

In the Paffin Bay, a negatively-temperated, very homogeneous mass of water flowing into the area from the south is located below the previously described positively-temperated intermediate layer. The floor temperature of the explored deeper sections of the area

amounts to -0.44° ; the salinity of the water as a whole varies between 34.47 and 34.49 per mil. The greater part of the floor water, which apparently renews itself very slowly, is probably formed in the northernmost section of Baffin Bay. It is a mixture of water formed from a little less salty but colder water flowing in from the Arctic Ocean through Smith Sound and Lancaster Sound and from the warmer and saltier water in the Atlantic intermediate layer.

Summarizing the facts outlined thus far concerning the seas between Greenland and the Canadian Arctic, the following may be said: Atlantic Ocean water flows into the area from the southeast together with the West Greenland Current and dominates the southern part of the seaways up to the ridge near Helstøinsberg, while the northern sector receives its special character from water of the cold Polar Current. Near Southwest Greenland, the water temperature is positive from the surface down to the floor, except for the small remainder of the East Greenland Current's cold part which, as a rule, loses its negative temperature during the summer and which, like the Polar Current, never is felt north of the Lille Hellefiske Bank. In all of the area to the north of the Store Hellefiske Bank, the positively-temperated part of the West Greenland Current constitutes only a very thin surface layer; even during August the temperature there is negative already at a depth of 20-50 meters. At the end of the summer (in September), the positively-temperated surface layer appears to reach a thickness of about 100 meters close to the coast as far as past the Umanaq Fjord; but towards the winter, when the coastal current probably ceases, it is likely that the cold surface water expands from the western and central parts of Baffin Bay all the way to Greenland.

Of special interest are the hydrographic conditions on the banks between Frederikshaab and Disko Bay, the site of deep sea fishing. The possibility for the occurrence of fish depends to a very

high degree upon the interrelationship between the West Greenland Current's two separate masses of water: the Polar water and the water of the Iringer Current.

During the winter, when the currents are weak and move outside the banks, rather stagnant and cooled water forms above the banks. At the beginning of summer, the always fairly stationary water will warm up by sunshine, a process which slowly continues from the surface down to the bottom. If a little later the Polar Current makes itself felt above the southern banks (as far as the northern end of the Lille Hellefiske Bank), it will counteract the rise in temperature. This cooling effect is naturally more pronounced during years in which the current moves with greater speed and therefore is pushed closer toward land and around the banks; if the speed is low, it reaches only the outer fringe of the banks, and the rise in temperature therefore continues without interruption. As a rule, the Polar Current loses in strength in the middle of August; afterwards, the Iringer Current usually sets in around the banks, and this current reaches its maximum late in fall or during winter.

Above the northern banks, as a rule, the warming of the surface by sunshine sets in somewhat later than farther to the south, but on the other hand, once started, it continues unobstructed throughout the summer. At the beginning of the summer, there is often still a great deal of cold water above the northern section of the Store Hellefiske Bank which had spread eastward from Baffin Bay. Only after it disappears from the area can the warming process really start. The large yearly variations of the factors determining the hydrography of the banks, i.e., variations of the East Greenland, Iringer, and Baffin Currents and variations of the meteorological conditions, easily explain why conditions on the fishing banks -- especially temperature conditions -- differ greatly from year to year.

Ice

So far, we have discussed only the masses of water around Greenland, their extension, lengths, and currents. But neither the depth of the ocean nor the interrelationship between the waters of the Atlantic Ocean and Arctic Ocean directly characterize the Greenland seas. When one approaches Greenland by sea, the first impression one forms of the country is usually and inextricably connected with the ice floating in the ocean, and which one encounters in all seasons along most parts of the coast. During clear weather, everybody enjoys the brilliant spectacle of these masses of ice; but when the weather closes in, the spontaneous happiness over the ice is replaced by the navigator's concern for his responsibility of directing the ship, whereby the tension connected with the voyage increases with the number of difficulties. Sometimes his concern may grow intensely; it is hardly a desirable situation to have heavy ice, together with a severe combination of storm, intense snowfall, and dispersal.

All ice consists of frozen water particles; but the way in which different kinds of ice are formed, gives to every variety of ice its special characteristics and geographic distribution. The knowledge of that is not only of theoretical, but also of practical importance.

The ice floating in the ocean consists partly of sea ice and partly of glacier ice (ice fields). The ice fields near Greenland stem mostly from Greenland's inland ice. The sea ice is shallow in contrast to the usually deep ice fields, but it is often of large horizontal extent and is formed either off the coast or is brought there partly by the East Greenland Current and partly by the seas off Northwest Greenland to the north and west.

RESTRICTED

The sea ice is formed during the winter in all waters inside the Polar region by a cooling of the upper layer of water. Newly-formed sea ice contains salt particles, which during the following summer or summers, if the ice has not melted before, ooze through the fine pores of the ice. The faster the formation of the ice takes place, the more salt the ice will contain.

The sea ice may be subdivided into two main forms, according to origin; fast ice and drift ice; the drift ice furthermore can be subdivided according to its geographic occurrence into polar ice and pack ice.

In the Arctic Ocean tremendous quantities of fast ice are formed every year from the coast out to the shallow sea. The largest areas for the formation of fast ice are the broad North Siberian continental shelf toward the Polar Basin and the sounds in the North American Archipelago. In Greenland, the fast ice is formed in the numerous protected fjords and bays; the farther north one goes, the larger the extent and thickness of the fast ice close to shore. The Vajrat and Umanaq fjords may freeze over every winter, and in Melville Bay the ice usually forms in an arc from Wilcox Head to Cape York 50-100 sea miles off the coast. On the east coast of Greenland, the fast ice, because of the passage of ^{the} cold East Greenland Current, has a much greater extent than on the corresponding latitudes of the west coast.

During the winter the fast ice attains a thickness of about 60-70 centimeters near the settlements of Northwest Greenland and a thickness of about 2 meters north of Siberia. Its distance from the coast is regulated by the destructive effect of the ocean and of the masses of drift ice on the seaward border of the fast ice; thus the fast ice, as a rule, reaches its greatest width by December, but its thickness continues to increase until May. The innermost, small belt of fast ice attached to the shore and uninfluenced by waves

and tides, is called the foot of the ice. It is usually thicker than the rest of the fast ice, which fact, in conjunction with the upward and downward action of the seaward-lying masses of ice, results in the formation of one or several tidewater channels near and parallel to the coast. When during summer the sun regains its strength, the inner section of the fast ice detaches itself very quickly. The outer part of the ice mass, which thus becomes free from its connection with the shore, starts moving and joins the ice floating in the ocean.

A special type of fast ice is the so-called "sikussaq", i.e. ice which is formed in the protected fjords out toward the Arctic Ocean under conditions that make the melting during summer difficult or impossible, so that the ice seldom if ever breaks up. In order to be called "sikussaq", the ice has to be so old (10-25 years) that it has become fresh-water ice and moreover has formed such a granular structure that it becomes impossible to differentiate it from ice-field ice. Several of the fjords on the north coast of Greenland are covered by "sikussaq".

A substantial part of the North Siberian fast ice, not melting during the short arctic summer, floats away from the coast and joins with the polar ice, which forms the second most massive ice cover above the central sector of the Arctic Ocean and fills about 70 per cent of the total surface of the Arctic Ocean. The decrease in the quantity of ice occurring in the Arctic Ocean each year by ice being carried out of the Arctic Ocean by the different ice currents is compensated for not only by the inflow of broken-off fast ice but also by ice formation in the basin itself, especially under the already formed ice. Polar ice fields may reach the considerable age of 4-5 years; they are homogeneous with respect to thickness (3-5 meters), of very low salinity, and almost free of air bubbles,

which makes them hard as well as heavy. The main part of the ice flowing out of the Arctic Ocean passes between Spitzbergen and Greenland.

In some areas of the Arctic Ocean, a particularly strong massing of ice takes place because of the predominant winds and currents and the shape of the coastline: e.g., in the area to the north of Greenland and at Ellesmere Island, as well as in the small sounds off Kane Basin to the north. Paleocrystic ice, a special kind of polar ice, is formed there by constant pressure and packing; since it remains stationary in the same place for years, it may attain considerable age and may at times be mistaken for ice fields.

The expression pack ice is used for all sea ice that under the influence of winds and currents floats away from the area of its formation and does not belong to the geographically centered polar ice. Pack ice is composed of very different types of ice: broken-off, locally-formed fast ice, ice fields, and floes of various age, as well as ice which separated from the polar ice. The pack ice current usually consists of an outer section of small and often spread-out ice floes with small hummocks, washed adrift at the outer edge; more to the center, the icefields become larger, deeper, and often tightly packed. Melting water originating on land may form a belt of open water close to land in the summer, the so-called land water. One may find systems of channels and fairwaters between ice fields; ice is classified as more or less open, according to the possibility of crossing it. The horizontal extent of the pack ice depends on the season of the year, but large year-to-year changes may occur for the same month.

Generally the pack ice follows the cold oceanic currents, i.e., along East Greenland or along the east coast of North America.

The East Greenland pack ice current has the deepest ice of all the southward-moving pack ice currents; these originate partly in the Arctic Ocean and partly in the Barents and Kara Seas; finally, the current carries along fast ice broken off from the East Greenland coast.

With the beginning of winter, the pack ice current is increased by large masses of heavy ice floating from the north into the Greenland Sea, from whence they push gradually southward in the following months along the Greenland coast, where the width of the ice belt steadily grows. The first part of these increases occurs in October near the Scoresby Sound, in November near Angmagssalik, and in the last half of January near Cape Farvel. The ice fills the Sullanebaab Bay in February, reaches Arsuk in March, Pistenaa in April, and arrives near the latitude of Godthaab in May, if the "field ice" (name used for the East Greenland ice in West Greenland) even extends that far to the north, an event which does not happen every year. Off Greenland to the west, the largest quantity of field ice is encountered in May or possibly also in June; in July the quantity of ice decreases; in August the ice reaches only Ikarsarsuit, or even disappears completely from the west coast. The above-mentioned dates and limits are only averages, from which considerable deviations are possible. The area near Angmagssalik, at a point where the coast curves westward and where the current-borne ice floats away from the coast, may become almost completely ice-free in July. At that location, October is the most ice-free month; ice has been present only in very few years at this time.

In years with very strong ice formation, the ice may extend up to the north coast of Iceland during the spring. The ice limit off Iceland to the north always has a characteristic tendency to spread eastward, probably under the influence of the East Iceland Current.

The speed with which the ice floats southward along Northeast Greenland is the result of the current's setting and of the force of the prevailing northern and northeastern winds. It reaches up to 14 sea miles per day in the outer sector of the ice belt and 4-5 sea miles per day in the inner sector. Between Angmagssalik and Cape Farvel the average speed has been reckoned at 9 sea miles per day. The drift of the central and landward sectors of the ice belt is very irregular. The wind is largely responsible for the aperiodic changes of drift and for the packing of ice.

Off Cape Farvel to the south, where the forward-pressing ice seems to have a tendency to heap up, the ice belt may reach a width of more than 100 sea miles during May-June. Strong winds between the north and east may drive the ice considerably far out into the Labrador Sea, but there is no reason for assuming that the East Greenland ice will ever be driven from Cape Farvel across the roadway to join the ice of the Labrador Current.

The other large pack ice current to be found in the seas around Greenland is the North American pack ice, which in Greenland is called "western ice" and which mostly consists of ice from Baffin Bay, but which is supplied moreover with ice from the Polar Basin and the North American archipelago between Smith Sound, Jones Sound, and Lancaster Sound, and with ice from Hudson Bay. The ice in Baffin Bay reaches its greatest extent during March, when it may fill 1/5 of the area; in some years Baffin Bay has been completely filled with ice. The ice reaches its smallest extent during August and September, when the main part of it is either carried away or melted.

In Baffin Bay, the ice is driven by the previously described surface currents; the ice is carried by the Baffin Current and the Labrador Current southward past Newfoundland, where normally it reaches its greatest extent in February, before spreading and melting.

Hummocks of this pack ice current have been observed as far south as 120 sea miles off the southern point of Grand Bank, southeast of Newfoundland.

When winter sets in and the limit of the Baffin ice is displaced toward the east, the cyclonic motion of the current in the southern part of Baffin Bay speedily directs the ice toward Disko Bay and toward the Greenland coasts to the north of it. In this way, the Baffin ice (western ice) may appear there even in November; frequently the western ice is seen during December and January in the Longfjorde District and during January it might reach the coast at about 66° northern latitude. From Disko Bay northward, the pack ice around this time may freeze together with the winter ice near the coast; ~~it might be still present in considerable quantity near the coast;~~ it might be still present in considerable quantity near the coast of this area during April and May and in the area from the Umanaq fjords up to the north even during June. The coast is ice-free from July to October up to north of Nuermavik.

To the north of Nuermavik, ice conditions are more varied. In some years there may be open water along the coast up to the Kane Basin, in other years the Melville Bay and the adjoining ocean are tightly packed with ice. In the southern part of Smith Sound, between the ice currents along Ellesmere Island and along Greenland, is an area where the water, even in cold winters, remains open to an amazingly great extent. Of the different factors which jointly have the effect of preserving that so-called "North Water", the following may be mentioned:

1. The inflow of surface water into the area takes two routes: one from Melville Bay close by Cape York and the other from the north through the smallest part of Smith Sound. During the winter, the fast ice forms sufficiently far out in Melville Bay to stop the inflow of drift ice from the south, and the seaway between Greenland

and Ellesmere Island freezes over completely north of Ita, so that from there likewise no drift ice can enter the area.

2. The stability of the water, which in that area is high because of the inflow of sun-warmed surface water, decreases during the winter, probably to such a large extent that with the cooling of the surface during the winter, vertical currents come into existence even at very great depths, whereby the formation of ice on the surface becomes difficult or even totally impossible.

3. Northern and northeastern winds are usually predominant and very strong during winter, and contribute to keeping the seaway free from possible ice.

The "freedom from ice" of the North Water is only relative, i.e., in relation to the more tightly packed ice areas north and south of it.

The ice fields near Greenland have their origin, as mentioned previously, almost completely in the inland ice covering Greenland. The inland ice consists of snow crystals, which gradually are transformed into solid, granular ice. During this process, a large amount of air is locked into the ice mass, so that its structure is different from common, pure ice. The ice fields are only seldom formed of completely homogeneous ice; often it is crossed by blue or green stripes consisting of refrozen water from melted ice which at one time had run down from the surface of the ice field ice through cracks in the ice. This pure refrozen ice, often encountered in the vicinity of ice fields in the form of fairly large pieces of calf ice ("blue ice" or "black ice"), is considerably harder than the ice-field ice itself and is difficult to spot because it is almost as clear as glass and because it lies deep in the water, due to its great density.

For different floating ice fields, the relationship between the part of the ice field above the surface and that below the water level differs with the variations in density, which in turn are caused by the heterogeneous distribution of air inside the ice and by the type of ice. That ratio, which on the average can be fixed at 1:7, is otherwise only of purely theoretical importance, since the ice fields almost always extend more under water than above the surface, and furthermore have such irregular shapes that one cannot form an opinion on the draught of an ice field merely on the basis of its elevation above the water level.

However, one may establish a scale arranged according to the appearance of the ice fields, ranging from the bare strips, massive fields to the hollowed out, partially melted pieces of ice. On the basis of direct measurements of ice fields which strike the ~~guny~~^{guny}d, the following values have been derived in which the expressed ratio between the ice field's elevation above water and the ice field's draught varies with its form:

1. Blocky ice fields with steep sides..... 1/5
2. Rounded ice fields..... 1/4
3. Light, cleft ("picturesque") ice fields..... 1/3
4. Strongly cleft ice fields with slender spires..... 1/2
5. Ice fields and pieces of ice in the last stages of melting, washed out and perforated..... 1/1

The ice fields are discharged by the glaciers in Northeast Greenland prevent the sea ice from drifting southward. Ice fields in the East Greenland Current spread along almost the entire east coast, but only off Scoresby Sound to the south do real belts of drift ice occur in large quantities. Because of the very many obstructions encountered by all the East Greenland ice fields on their way along the coast, only a small number of them reach Cape

Farvel. Near Cape Farvel, they continue westward and northward; some of them reach an area outside Godthaab, while others are carried away from the coast, unless they are grounded on the banks.

While the main part of the drifting ice fields, just as the sea ice, remains in the East Greenland Current and in its continuation along West Greenland, some of them, in consequence of storms, may be carried far away from the cold Polar Current. In places where a hunk of sea ice will greedily be destroyed by relatively warm water, an ice field can hold out much longer because of its greater mass, and therefore ice fields have been spotted as far out as 250 sea miles southeast of Cape Farvel and 200 sea miles west-southwest off Arqut; the latter area is about halfway between Greenland and Labrador. On the other hand, a general passage of ice fields from Cape Farvel southward into the Atlantic Ocean or across the seas to Labrador is out of question.

In the waters around Cape Farvel, the largest drift of ice fields occurs in April. The quantity of ice increases steadily during May, June, and July; in June and July most of the ice fields are encountered west of Cape Farvel. In August, a new drift of ice fields from the east comes around Cape Farvel; this one is much smaller than the drift of ice fields during April, and decreases steadily in the following months.

By far the largest number of all ice fields originate in the glaciers of West Greenland, mainly in Jakobshavn, Torngakatak, the Umanaq and Karrat Fjords, the Godhavn district, and in Melville Bay.

The discharge of ice fields from the glaciers of Northwest Greenland is obstructed during the winter by the fast ice forming off the coast, but once the ice has disappeared, the fields are carried away from shore by currents and wind and continue to float

RESTRICTED

in a northerly direction. An ice field, detached in this way from the fast ice in Disko Bay or the Umanaq Fjords during June, may spend the summer on the ocean, then stay over the winter in Melville Bay, where it becomes free the following summer. Then it passes Cape Dier on Baffin Island during October, in order to reach the area south of Newfoundland the following May, where it will rapidly be disintegrated in the warm water of the Gulf Stream. However, this route is in no way normal for ice fields; most of the ice fields are brought to a standstill for many years by banks, reefs, and fast ice, and only a total of about 400 ice fields, i.e., 1/20 of the ice fields originating in West Greenland, reach Newfoundland.

Summarization of: PUBLIC ADMINISTRATION AND ADMINISTRATION OF JUSTICE
 THREE OF THE TOPICS - THE RELATIONSHIP BETWEEN DENMARK AND GREENLANDERS.
 Copenhagen, Greenlandic Paper, Vol. 11 (pp 17-30), 1950.

PUBLIC ADMINISTRATION

1. Brief History.

The administration of Greenland was until recently almost unaltered, in the hands of the Commissioners of the Royal Greenland Trade. When the present local type of administration was in use in Denmark, questions concerning Greenland reached the King and his counselors only on rare occasions. With the introduction of the minister-type of administration in 1818, Greenland affairs came under the Ministry of the Interior. Greenlandic problems, designated as "the Greenlandic problem", were then placed in the hands of a special official, while similar affairs were handled by the local authorities (commenced in 1895 the Greenlandic Ministerial Council, but are now handled by a representative of the Ministry of the Interior). In 1905, regular Danish land bills were introduced for the first time to Greenland with the purpose of a tax on the Greenlandic land and forest. Since 1910, all laws concerning Greenland are administered in the Ministry of State, which sets up a special department called the Administration of Greenland (Greenland Ministry).

2. Constitution.

Greenland is a Danish colony in which the Kingdom of Denmark is sovereign. Every Greenlandic acquires Danish citizenship at birth. Greenlanders therefore can hold positions in the Danish government service and are subject to military duty, if they take permanent residence in Denmark.

3. Administrative subdivisions.

According to present decrees, Greenland is subdivided into three provinces (landsdel):

RESTRICTED

South Greenland, extending from Lindensø Fjord to Nordre Strøem Fjord.

North Greenland, extending from Nordre Strøem Fjord to Nordost Sundingen.

East Greenland, extending from Nordost Sundingen to Lindensø Fjord.

All of South Greenland and the part of North Greenland lying to the south of the 72° northern latitude for administrative purposes is subdivided into districts (bygd), settlement districts (kolonialdistrikt), communes (kommuner), island districts (ølandsdistrikt) and parishes (parochier). Their respective centers are listed in detail by royal decree. Districts to the East Greenland and to the north of the 72° northern latitude will be dealt with in the chapters "East Greenland" and "The Arctic District". The development of administration and other conditions for North Greenland and South Greenland will be treated in one unit.

1. Greenland's progress towards self-administration.

The monopoly for the local Greenland trade, for a long time the exclusive right of Greenland, was in earlier law called the "monopoly trade", but should more correctly be called "The Danish State's administrative and protective trade in Greenland". By a royal decree of 1776, the monopoly trade for the account of the state became securely established. At the same time, an embargo on foreign navigation to the country was proclaimed. Monopoly trade and isolation by embargo up to now have served as the basis of all administration and activity in Greenland.

Social structure of Greenland before colonization: Danish colonisers started their civilisatory and cultural work in 1721. While treatment of the Greenlanders in general was humane, the shock effect caused by an advanced civilization on the primitive society of Greenland was inevitable. The Eskimos had formed a well-balanced community of hunters and fishermen. Strong dependency on nature was counter-

RESTRICTED

balanced by stooping, which in turn was made possible by a highly developed fishing technique and good communications. Public welfare measures were well developed, and Greenlanders, by sealing alone, provided a tolerable minimum standard of living. It was not a society in the modern sense, with written laws, etc., but certain forms and customs took the place of laws and tribunals. Society was administered in a primitive, but satisfactory way. The self-governing individualism of this society of hunters and fishermen was limited by a kind of socio-economic communism: everyone had to share the catch with the family, the tribe, and even the settlements. Society had a guarantee against individual idleness by an unwritten, but generally observed, law requiring every able-bodied man to learn the fishing trade. One informant was a doctor. The settlers were poor measured by our standards, but led a good life according to their standards. No riches could be accumulated, but a society which ensured its members the satisfaction of their minimum needs compensated for that.

European transforms Greenlandic society: It is obvious that the ideas of European settlers were completely incompatible with such a state of affairs. Friction developed, especially in the following fields:

- a. Labor: The status of equality was immediately violated. A relationship of subordination came into existence when Greenlanders started to perform services for the colonizers. Because of their occupation, these Greenlanders were then out of the normal social framework, which was based on the community idea. Thus a class of laborers was created.
- b. The introduction of a money-economy eliminated the self-sufficient communities and their customs of economic exchange.
- c. European products. The imported new products from Europe were sold at exorbitant prices.

d. Foreign culture. The introduction of a foreign culture was regarded by Greenlanders as a violation of their rights. Their age-old concepts of the world, their simple heathen ideas of a balance between matter, human beings, and man's souls were, without warning, confronted with totally new cultural concepts.

e. The formation of permanent settlements by missions and traders in the interest of better supervision and administration disturbed to the utmost the individualistic and nomadic habits of the population.

The Danish State takes over trade and administration: The unfortunate effects caused by the introduction of an advanced civilization into primitive wilderness were felt by ever-widening circles of the population.

a. The transition period: During which the old Greenlanders were still in effect and Danish administration was still in its formative stage was characterized by economic recession. Relief was provided by private and public loans or grants, and since the old time community socialism was unable to cope with problems of such magnitude, the initiative slipped from Greenland institutions gradually in the hands of the Danish colonizers. As the economic situation worsened and discontent became general, the Danish State finally had to take over the administration and trade of the country in a systematic manner.

b. The trade inspectors: In 1782, detailed and general instructions for all residents of Greenland were proclaimed. They aimed at protecting the native population and at creating stable and orderly conditions in all spheres of life. Local merchants were made subordinate to two government officials, the so-called royal inspectors for trade and sealing, one for North Greenland and one for South Greenland. These two inspectors were not only the government's representatives, who had to see to it that the "instructions" and other regulations of the Directorate were carried out, but they were at the same time the deputies and spokesmen for Greenland at the Directorate in Denmark.

After restoring the equilibrium of a society shaken in its foundations, it was the task of the inspectors to improve conditions as much as possible.

Boards of supervisors: An important move to include Greenlanders in the administration of their country was made by a group of prominent Danes, with the scientist and administrator, Dr. P. Rink, as leader. In order to prevent threatening stagnation, Greenlanders had to be imbued with a renewed interest in their own community affairs and to be taken out of the isolation which colonization had brought them. Despite initial difficulties, the idea took root and was supported by the concepts of freedom contained in the new Danish constitution of 1848. In 1862, the so-called boards of supervisors (forstunderna) were created with the idea in mind of promoting the fullest possible cooperation between Danes and Greenlanders. Each of the 12 boards consisted of the settlement's priest as chairman, the merchant (factor of the district) as co-patron, the doctor, one assistant, several other Danes and Greenlanders elected by the population. Besides participating in the meeting, it was the task of the Greenlanders to maintain order in their districts. The financial means of the boards were made available by contributions from the Monopoly Trade. Furthermore a common fund (faelleskase) was established in North and South Greenland respectively. The money was used for social welfare, the establishment of small businesses, etc. The balance of the money was distributed to Greenlanders according to their individual merits.

The boards of supervisors served as a school where Greenlanders acquired the know-how of government. They were operative for a long time and when they lost their importance, a foundation had been laid for an administrative and political structure.

The local and provincial councils: The boards of supervisors were succeeded by the local and provincial councils, which became law in 1908. They owe their existence to the activities of J. Daugaard-Jensen, then inspector for North Greenland and later director of the

Greenland Administration. The basic idea of these new political organs was to let Greenlanders handle their own affairs without help by the Danes. In every commune a local council (kommuneraad) was formed. The members were elected exclusively by and for Greenlanders, and the council itself elected a chairman and took care of the local treasury (kommunekasse).

For each of the two provinces (North and South Greenland), a provincial council (landsting) was established which was to meet once a year to deliberate on matters concerning the province as a whole. Its members were elected in special districts (kreds). Only Greenlanders could be elected as members. While the widely dispersed and independent 12 groups of Greenlanders could have no real legislative functions, the provincial councils assisted considerably in the law-making process.

Furthermore a Common Fund (fællesting) was established. Its function was to promote projects beneficial to the whole country. The financial resources for the three public funds -- the common, the provincial, and the district funds -- came from the economy trade and from the proceeds of a 20-tax on the salaries of public officials.

The basic defect of the local councils was that Greenlanders were assigned more work than they could handle. Furthermore, it was felt that the complete exclusion of Danes from the administration had gone too far. Gradually opinion shifted again in favor of inclusion of Danes into the administrative structure. King's idea of close collaboration was revived, but the principle of the provincial and local councils proved to be so sound that these two administrative organs were kept intact during the following reorganization.

The Administration Law of 1925:

The Administration Law of 1925, which is still in effect today, defines the participation of Greenlanders in the administration of the country. It provides for the following:

*Note: See article "The New Laws of Greenland" for recent changes

Communal councils (kommuneraad) are elected by Greenlanders and Danes alike and both groups can be elected to the councils. The same rights now apply to women. The local funds lend assistance to the needy and make grants for community projects, trade schools, medical assistance, etc.

District councils (sysselraad) are a completely new link in the administrative system. They are composed of the chairman of the communal councils, the representatives of the executive committee in the Provincial Council, and of the district officers for the respective districts. The number of members in the council never exceeds that of the Greenlanders. The district director has the function of controller and is a permanent member of the council. The chairman, called the district officer (sysselmand), is appointed by the provincial governor (landstyre) with the consent of the Minister of State. Just as under the four-branch system, Danes as well as Greenlanders are statutory members. Of the many functions of the district councils, the following are of particular importance: administration of district funds, maintenance for the employment of labor and for tests, payment of old age pensions, financing of public projects like public buildings, construction, etc.

Provincial councils: The 14 provincial councils are set up to discuss matters of general, province-wide interest. The provincial governor, whose office corresponds to the old office of the inspector, is ex-officio chairman of the council. The council cooperates in the drafting of legal norms, all pending new laws and decrees. Every member of the council may initiate motions, inquiries, and complaints in all matters of public interest. Therefore the council has far-reaching and broad powers. The members of the council are elected district-wide every six years by the members of the communal and district councils residing in a given district. The council cooperates in matters dealing with the use of the provincial fund. Furthermore, the council administers the so-called "Common Fund" (fællesfond)

which is under the jurisdiction of the Minister and aims at the development of projects benefiting the population of Greenland.

5. The Government of Greenland.

Law on the Government of Greenland: The collaboration between Danes and Greenlanders, which characterizes Greenland's progress toward self-administration, is likewise to be found in the field of general and local government. Originally the general administrative functions were vested in the colonial trade. Local government was exercised under the Inspector's general supervision by trade officers, judicial authorities, and police officers. This power centralized local government was replaced in 1912 by the inspectorate system, which was in effect until 1925.

The first law on the Government of Greenland was passed by the Danish Parliament on 27 May 1908. It introduced the principle of separation of national and local government. Likewise, it effected a split in authority on the high governmental level by separating it into the Administration of Greenland (general) on the one hand and the Royal Greenland Trade on the other. The former was under an administrative director, while the latter was under a special commerce chief appointed by the Minister of the Interior. In theory, these two officers were supposed to coordinate their respective competences, but in practice this arrangement led to chaotic conditions in all too many cases, government work in Greenland was stymied by conflicting orders of the two chiefs. The law of 8 June 1912 on the common administration of Greenland brought the return of a single chief in the person of the director of the Greenland Administration.

The law of 18 April 1925 up to the present time is the basis for the general government of Greenland and also controls the local government of the country:

Greenland affairs in the Danish Parliament: The political forum for Greenland is the Danish Parliament. With the passing of time, a rule developed whereby all the major and important decisions of the Danish Parliament concerning Greenland had to be in the form of laws.

But besides those laws, many norms were and are established by royal decree. Moreover, the prime minister promulgates official notices and regulations, and the Administration (Styrelsen) issues its directives.

A parliamentary committee on Greenland affairs, composed of eight members, renders opinions on general questions concerning Greenland, e.g., on changes in the regulations governing admittance into the country, matters of monetary trade, etc. The committee has the right to gather information on all problems related to the government of Greenland and on all questions affecting the Greenland population.

The Administrative Directorate of the Prime Minister. The appropriation for the government of Greenland is included in the annual budget. All Greenland affairs are handled by the prime minister through a director of the Greenland Administration (Styrelsen), who refers all matters which are not up to his discretion to the prime minister. It is the duty of the director to make an inspection tour of Greenland every three years; under normal conditions, this trip is made yearly.

The director of the Greenland Administration is the immediate superior of the highest civil and ecclesiastical officers of Greenland, i.e., the two provincial governors (landsover) and the ecclesiastical dean of Greenland (provst). Under the director, a chief of commercial affairs (handelschef) is charged with the purchase of all products for Greenland that are subject to import regulation. He is, in certain respects, an independent government official, but in commercial affairs he becomes a counselor subject to the director. Other principal staff members are: ship inspectors, medical specialists, ichthyologists, technical advisors, and lecturers in the Greenlandic language. It is the duty of these advisors, among other things, to inform the director about all questions pertaining to the Greenland church and school system. Minor officials on the staff of the director of the Greenland Administration are: bureau chiefs and their personnel, trade inspectors

Note: Now only one land governor (s. "The New Laws Of Greenland")

(whose main duty is the supervision of commercial affairs in Greenland), inspectors of cultural relations, meteorological inspectors, architects, and many others.

The local aspects of the government of Greenland: The above outline shows how Greenland affairs are handled from Denmark.

Inside Greenland, the following governmental structure applies:

Governors of provinces. To each of the two provinces, North and South Greenland, the King appoints a provincial governor (landsfoged). These governors must meet the same qualifications as required for a judgeship in Denmark. The governors have their official residence in Godthab and Godhavn respectively. The job they have to perform is unique in many respects: their official travels take them to the distant and desolated areas of the country, and in many respects the governors are subject to the risks of exploration. Their satisfaction lies in the satisfaction of seeing their labor bear fruit in a barren and undeveloped country and in the independent position afforded an officer who governs far away from the land-office.

The governor of a province is the representative of the Danish Government and as such is the highest authority in the country. Under extraordinary circumstances, he may independently issue orders which are in the best interest of the country. He is the highest political authority. The general supervision of the health system is another of his functions. He assumes the role of a judge in local matters concerning persons subject to Danish law. He supervises the local administrations on behalf of the State and ascertains that commercial affairs in general influence the country's economic life in a favorable way. As chairman of the Provincial Council, he participates in the regional aspects of administration.

Other officials include the district physician, administrators of settlements (kolonibestyrer), technicians, comptrollers, teachers, etc. For every district the provincial governor appoints a district chairman (sysselmand), who under certain circumstances becomes the representative of the governor.

* Ibid.

The settlement administrator (kolonibestyrer): A permanent law makes it mandatory that commercial operations in Greenland be carried out in a manner benefitting the economy of Greenland and that they be reserved for the Danish State acting through the prime minister. Commercial relations are unrestricted between Greenlanders. The king appoints resident administrators of settlements who assume the general direction of commerce in their respective districts. The staff of the office of settlement administrators consists of settlement attorneys, first assistants and assistants, trade administrators and their assistants, etc. Positions are filled by Danes and Greenlanders alike. Greenlanders even have preference so far as assignment to a scientific ship at the Greenland Administration Office in Denmark is concerned. The functions of the settlement administrators are numerous: they supervise all public works, they enforce the trade control, they receive, store and ship merchandise. They supervise the movement of ships as well as the mails, they handle the day-to-day administration, supervising fishing and related activities, and direct the movements of the herds of the country's herds. They are responsible for the supply of artifacts as well as for the issuance and ordering of permits, including those of the savings banks. They direct the purchase and processing of Greenland products. The provincial governor and the trade inspector exercise a certain degree of supervision over all these activities.

ADMINISTRATION OF JUSTICE

1. Historical development: The original legal system was a common law system consisting of customs which had developed into generally accepted rules. No special law enforcement authorities existed, and public opinion watched over the observance of established rules. The death penalty was an outgrowth of witch hunts and vendettas. This primitive system of justice was gradually weakened with the appearance of Europeans in the country.

The Instructions of 1782 and the inspectorate system aided greatly in the organization of justice. But it was mainly up to the boards

RESTRICTED

of supervisors to bring method into the loosely-ruled system of justice. Step by step, a law order was established, and a more settled legal system replaced the partly anarchic and partly patriarchal setup. The boards of supervisors had to decide on all litigations, especially on civil matters like inheritance cases, etc. Their opinions were final, and the opinions of the Greenland leaders of the boards had priority, in order to give the native concepts of law the widest possible play. Rules of procedure as well as ordinances concerning the daily life were established. Sentences were published because of the Greenlanders' exact respect for public opinion. The council consisted of: members from the community, including of course the ruler, limited exclusion from teaching to stores, etc. The general principle was not to punish the transgressor, but to lead him in the right direction.

Only few rules existed on what was to be law, and even greater difficulties arose because of the Greenlanders' natural tendency to decide legal matters by set rules.

When the English began colonization in 1814, two legal systems had been evolved: one for the native population and the other for non-Greenlanders, who were treated according to the rules of Danish law. For the latter, the Greenland law was too old and alive, and for the Greenlanders, the Danish system was too complex and difficult to understand.

With the establishment of the communal councils, conditions changed considerably. The general council had to decide on all matters of civil law, while all criminal law cases were under a new institution: the gild court. It was composed of the inspector or his deputy, the chairman of the communal councils located in the respective court districts, and a Dane by appointment from the Minister of the Interior. The aim was to have Danes and Greenlanders set as correct rules of procedure and practical law opinions.

2. The present system is regulated by the law of 1925, which did away with the gild courts and replaced them by special district courts. To this court the Minister's supervisor (agassut) is appointed as

appointed chairman by the civil governor. For criminal cases of other cases, the District Supervisors select one judge and one Magistrate to serve as judges and for minor cases two judges and two Magistrates. The local councils, which are charged with the enforcement of public order, report all criminal cases in their respective districts. The civil matters, a complete set of detailed rules on education, local government, and so on is in force. The law is not and is constantly under, special rules apply. With the cooperation of the provincial council a large number of local rules on a kind of local level -- were developed which proved to be well suited to the purpose. But it must be stated here that increasing complexity and the increasing development of the country have necessitated further development of the law. At present, 20,000 local regulations are in force. In this book, 20,000 local regulations are spread over 100 pages and are divided into hundreds of sections on order, public order, food, health, and other matters. Under the surface of this complexity, however, there are still some basic, and large problems which are not solved by the North and South Greenland. Furthermore, differences exist between the conditions of large settlements, settlement-outposts, and small settlements. These basic conditions make it extremely difficult to set up a common judiciary machinery and a set of law which could be satisfactory to all, or even only to a majority. This is especially true for the criminal code. As to the present law, prison and a police force are unknown concepts, and only a few types of modern penalties are in existence. In practice mainly the following penalties are used: death penalty and penal labor coupled with expulsion from the settlement. A prison system would be very difficult to establish because it would be impossible to have a prison in every colony. Therefore, in view of the impossibility of developing a complicated law enforcement apparatus, Greenland will have to stick to a wild form of law enforcement.

DANES AND GREENLANDERS

In general, relationships between Danes and Greenlanders may be said to be good. Close cooperation exists, and in thoroughly democratic Greenland there is very little room for any feeling of superiority which might develop in Danish officials in their relations with other Danes and especially with Greenlanders. Only occasionally was a certain degree of hatred toward Denmark to be noted, especially before the new political and administrative organs were created. Naturally, problems arise here and there, e.g., the thalassophobia of equal wages for both nationalities, varying differences in the educational level and the standard of living. Other causes of friction are, e.g., the social and political convictions of Greenland voters and disagreements on language problems.

Generally, racial hatred is nonexistent. Neither the Danes react just only at work but also socially. A racial tendency toward class distinction and discrimination may be noticed in both camps. The two nationalities respect each other, and mixed marriages are in general not frowned upon.

Many of the scientific conditions could be carried out only because of the existence of close collaboration between Danes and Greenlanders. Much has been accomplished toward better understanding by the appointment of Greenlanders to administrative and educational offices. A strong link between Greenlanders and Danes is established by Greenland women working in Danish households. Increasing numbers of Greenlanders are sent to Denmark to study, which leads to an assimilation of Danish thoughts and customs. One difficulty of this educational program is that some Greenlanders, upon their return to Greenland, find that they have lost their roots in their native country. They are people sitting between two chairs, having left the narrow circle of their own people without having been able to assimilate completely the Danish way of thinking and living. But despite their uncertain position and their inner conflicts, they are excellent mediators.

Principles of Danish Administration: From the start, the guiding principle of Danish administration has been to see to it that the development from a primitive to a more modern and complex society has been slow enough for the understanding and the development of the native population.

In the same field, it has been the aim to let Greenlanders exploit the resources of the country and to aid them in their slow progress from day laborers to independent workers.

The cultural development had to be slow and in tune with the existing process of the population. Here, as in all other fields, the guiding principle has been and is: evolution instead of revolution! The law on Greenlandic Government of 1925: The Law of 1925, regulating the government of Greenland, was based on the work of the Study Commission of Greenlandic Affairs, which was established in 1920. The commission was composed of experts on Greenland, including for the first time also several Greenlanders. The opinion rendered by the commission stated as the main task of Denmark's work in Greenland the development of the country from its colonial status to independence. Independence is defined as a degree of maturity in social, cultural, and economic affairs that would enable Greenland to enter into full contact with the world after the isolation of the country had been abolished.

In order to assist Greenland's development to independence, close ties to Denmark's civilization and culture had to be established. For the time being the isolation of the country and the navigation embargo were to be continued. These ideas formed the basis for the Law of 1925.

Negotiations between Greenland and Denmark: Visits of the Danish Parliament to Greenland took place in 1923, 1931, and 1936. Minister of the Interior Hauge and Prime Minister Stauning visited the country in 1925 and 1930 respectively. In 1930 Greenland representatives went to Denmark to negotiate with the Greenland Committee and the Greenland Administration. They expressed their opposition to opening Greenland

either completely or partially in the near future; they were definitely in favor of preserving the system of navigation embargo and state trade monopoly. On the other hand, they asked that everything be done to develop Greenland into a mature community. They stated furthermore that Greenland could not grant permission to non-Greenland Danes to make a living in Greenland as farmers, sheepbreeders, fishermen etc. The country's resources in these particular fields were to be reserved to Greenlanders.

Because of the outbreak of World War II, Greenland lost contact with Denmark for five years and the Greenland Administration in Copenhagen was forced into inactivity. When, in the spring of 1945, normal contacts were reestablished, the Greenland Administration had to deal with a country which had changed in many ways. The war, separation from Denmark and close contact with the U.S., the presence of Canadians and Americans, and the steadily improving general level of education had brought about completely new viewpoints and problems. Therefore, Greenlanders again went to Denmark in 1946 for extensive negotiations which took place under the direction of Minister V. Buch. It was agreed that a five-year plan for development work was to be worked out, to take place in the immediate future in several specific fields. On the other hand, problems that would not become pressing during the next few years, like the monopoly trade and the navigation embargo, were not dealt with thoroughly. But there was agreement on the necessity for the eventual abolition of all isolative measures.

RESTRICTED

Summarization of : HUNTING AND FISHING IN GREENLAND, by Paul Magnus Hansen
 Greenland's Bazen II, p. 52-62

Up until a generation ago, hunting was almost the sole factor conditioning the existence of the native population of Greenland. Although the land animal life in Greenland was very limited as to variety, reindeer and fox being the only land animals important from the standpoint of hunting, whale, seal, and 'owl' abounded in the fjords and along the coast, and these were widely hunted by the Greenlanders.

The experience of generations has taught the Greenlanders the habits, movements, habitat, breeding grounds, etc., of these animals, and all native hunters were located in close proximity to the best hunting grounds. Seals have always been the most important source. The seal provided almost everything needed for daily life. Other necessities, increasing in demand with the rising standards of civilization, could be purchased from the shops in commercial centers.

The Hunting of Aquatic Mammals

Of the six varieties of seal found in Greenland waters, three remain in Greenland the year round, while the other three varieties are migratory and appear only periodically, as their breeding grounds are elsewhere. The three types found on Greenland at all times are the ringed seal, the bearded seal, and the sea leopard. The Greenland seal, the hooded seal, and the walrus, on the other hand, come to Greenland only at certain times of the year.

Of the "non-migratory" seals, the ringed seal, from the viewpoint of hunting, is the most important in the northern part of Greenland, where it is by far the most common variety encountered throughout the year. The large bearded seal is found only seldom in large numbers, and the sea leopard appears only in certain localities and small numbers.

Of the migratory seals, the Greenland seal arrives during the spring from its Newfoundland breeding places and remains mainly in Southwest Greenland until fall. The hooded seal is found in the Manrothalik area, and a large part of the population of the Sullianhaab District engages in hunting them. The walrus is found especially in the Thule District and in certain parts of the Godthaab District. The hunting of walrus had to be restricted because reckless hunting, especially during the breeding season, had decreased their numbers considerably.

Statistics on the seal catch have been kept since the middle of the last century in the form of the so-called "catch-books" (Sango-tintar). In South Greenland, the catch remained fairly constant from 1870-1880, when the yearly catch averaged about 20,000 seals. A big decrease set in around 1890, and from 1895 on, only 10,000 - 20,000 seals were caught per year. In North Greenland, the figures varied between 40,000 and 50,000 seals per year for the period from the middle of 1850 to the middle of 1870. From 1880 to 1910, the statistics show a yearly catch ranging between 60,000 and 70,000. Then a decrease set in, with the catch varying between 40,000 and 70,000 seals per year. The hunting of seals reached its peak in South Greenland shortly before 1900 and in North Greenland around 1910.

Seal whales (narwhal, white whale, and porpoise) were caught in North Greenland at an average yearly rate of 500-800 animals, while in South Greenland the catch decreased from a yearly average of 225 animals in the years 1900-1910 to 55 in 1930-1935. Black fish were caught only sporadically.

Most of the blubber derived from seals and whales is sold to the Greenland Administration. It is salted and packed into barrels and then shipped to the oil factory of the Greenland Administration in Copenhagen. The oil thus obtained is used as a component in the production of margarine. During the fiscal year of 1947, 48,600 tons of blubber were purchased by the administration.

RESTRICTED

The Hunting of Land Mammals

By comparison with the hunting of aquatic mammals, the hunting of terrestrial mammals plays only an insignificant role. The largest of the terrestrial mammals, the musk-ox, is found in Northeast Greenland in the Scoresby Sound area. Animal sanctuaries have been established for it, so that it is of no importance for hunting.

The hunting of reindeer is a favorite summer recreation for Greenlanders, who readily give up the more profitable fishing for the more exciting hunt of reindeer. In many instances, this leads to a depletion of provisions needed for the long and severe winter. Needless hunting led to a depletion of the reindeer herds and in 1927 to a limitation of the hunting season to the period 1 Aug to 30 Sep. Furthermore, slaughter exceeding the capability of the hunter fully to utilize the carcass was prohibited.

Blue and white Arctic foxes are found on both coasts of Greenland, and the production of blue fox skins between 1935-1939 amounted to about 2,500 pelts per year and that of white skins varied between 1,600 and 1,800 pelts per year.

Hunting of Aquatic Fowl

The hunting of aquatic fowl contributes considerably to Greenland's food supply, while the down is a welcome by-product. The yield of down from older ducks amounted to 250 kilograms per year in 1930-1939, while the yield of feathers from other sea birds averaged 12,500 kilograms per year during pre-war years.

Decrease in Hunting and Shift to Fishing

During the last 30 years, a radical change from hunting to fishing has taken place, especially in the central and southernmost regions of the country. Around 1920, the world-wide and steady mitigation of climate made itself especially felt in the natural conditions and in the wildlife of the Northern Hemisphere. The

changes in routes of aquatic mammals, as caused by temperature changes of the water, the impossibility of using certain hunting techniques, etc., led to a tremendous decrease in the catch from hunting. Besides the change in natural conditions, over-hunting had led to a depletion of wildlife. Especially the decrease in the sealing catch had far-reaching economic consequences. Especially hard hit by the decrease in the seal catch were the northwestern districts of Umanak and Ilulissat. (For example, in the Umanak District the number of seals caught amounted to only half of the catch at the beginning of the century.)

The rise in sea temperature, which proved so adverse to the hunting of seals and other aquatic mammals, had its compensating features. The rising temperature of the water brought large quantities of codfish close to the shores of Greenland. A tremendous expansion of codfishing took place, despite the fact that a real sealer looks down on fishing as fit only for women, children, old men, and invalids. (Even now, one may at times observe that the population will spend all its winter supplies on an uncertain seal hunt, while the codfish practically lie at their doorsteps and can be caught with only a minimum of effort and a maximum of profit.) The largest quantity of cod is to be found in South Greenland, where fishing is possible practically the year round. Therefore, the great change in Greenland's economic makeup, as caused by the shift to fishing, is most markedly felt in South Greenland. Together with the expansion of fishing, Greenland changed from a barter economy to a money economy. In contrast to the seal, the codfish does not provide most of the products needed in a Greenland household; instead, the haul is converted into money. This change is visible, for example, in such items as clothing or fishing craft; modern fishing vessels replacing kayaks and European clothing the sealskins.

Fishing

Fish for household consumption

Among the about 100 types of fish found in Greenland waters, only very few are of economic importance. Of the economically valuable fish, some are used only for consumption in Greenland households, while others are sold to the Greenland Administration, which in turn processes the fish and ships them either as a final product or for further processing to Denmark.

Among the fish for home consumption, the capelin is of major importance. Capelin fish are dried in large quantities for winter supplies and dog food. Other fish used in home consumption are the bullhead, the polar cod, the fjord cod, etc.

Fish for export.

Catfish/Barvatta: Catfish skins are used in the manufacture of shoes, etc. During the fiscal year 1947-48 more than 6,900 catfish skins were shipped to Denmark.

Turbot: Turbot is caught mostly in the Jakobshavn District. During the fiscal year 1947-48, 78 tons of turbot filets were exported to Denmark.

Halibut: The fishing of halibut reached its peak in 1926 with a haul of about 250 tons, and then it declined steadily until finally becoming unprofitable around 1935. The cause for the decline was mainly overfishing by ships of foreign nationality between the years 1920-1935.

Shrimp: The decline in halibut fishing made it necessary to find a substitute. Fishing expeditions and research by the canning factory in Holsteinborg led to the beginning of shrimp fishing in 1935, especially in the fjords of Aarsdloq and Ikertoq. The canning factory at Holsteinborg now has a yearly output of about 100,000 cans of shrimp. In 1948, new fishing grounds were found near Christianshaab and Jakobshavn. New factories for the canning of shrimp in Naarsaq and Jakobshavn will be in operation either in 1950 or in 1951.

Shark: The fishing of shark has always been of the greatest importance for North Greenland, especially for the Upernavik and Umanaq Districts, as well as for the different settlements on Disko Bay. In South Greenland, shark fishing started only around 1910 and developed in 1930 to considerable proportions in the fjords near Holstenborg. Shark is caught mainly because of the train oil gained from its liver. The oil is processed in the Copenhagen factory of the Greenland Administration. In the years 1900-1939, a fairly constant yearly quantity of 500 to 600 tons of shark liver was created.

Codfish: Codfish were brought to Greenland in great quantities by the increase in water temperature. They became the main source of livelihood in all of South Greenland and part of North Greenland. By now, 79 fishing stations have been established in which the codfish are split, washed, salted, packed, and shipped. The export of codfish is mainly directed to Portugal, Italy, Greece, and Egypt. The output of the fisheries in 1920 amounted to about 8,000 tons of codfish, and in 1946 reached about 14,000 tons.

The difficulties of the codfish industry lie in the scarcity of labor for salting and packing operations, which must be conducted continuously in order to empty the fishing sheds for new catches. The solution to the problem lies in the mechanization of fisheries and other port operations, which would free the necessary manpower. The construction of pick-freezing plants, especially for the freezing of small codfish not suited for salting, is under consideration.

The Economic Importance and the Problems of the Codfish Industry.

Within the space of 25 years which were characterized by the development from sealing to fishing, codfishing progressed from a neglected and despised sideline trade to the country's most important source of livelihood. This reliance on one product poses very serious problems for the future of Greenland:

Historical data show that the abundance of codfish near the shores of Greenland is periodic in character. The past century shows two periods of abundance, during the 1820's and at the end of 1890, but in between these periods and afterwards there were lean years, with almost no codfish near Greenland's coasts. The abundance of cod in the present followed nearly the same pattern as in the 1890-period. The present period of abundance cannot be expected to last forever. If the previous situation, characterized by low water temperature and small quantities of codfish, were to return, it would be a catastrophe for the Greenland population, whose existence is completely dependent on codfishing. It would be impossible to return to sealing, and another activity which could make up for the loss of fishing has not been found as yet. Agriculture is, for the time being, of importance only in the Umanak District, and other fish are only of local or little importance. Greenland's only alternative would be to turn to codfishing at the banks of Newfoundland and Iceland. But for that a sea-going fishing fleet would be needed, and as far the development of such a fleet is impeded by the fact that the codfish at present are so close to Greenland, practically at the fishermen's doorsteps. The use of larger vessels and more expensive equipment therefore is at present not necessary. It will be one of the tasks of the commission dealing with Greenland's future to create a sea-going fishing fleet.

RESTRICTED

Summarization of: ARCTIC LIFE, by E. A. Christensen
 Grønlands Bogen, Vol. 13, p. 83-94

In the 1700's Norwegian-born settlers (Gleens) introduced domestic animals, mostly Danish, sheep, cows, to Greenland. He and his descendants lived in Gardar (now called Igloolik), which for a whole century remained the only place at which arctic life was carried out as a livelihood. Around 1900, with the substantial decrease in the seal catch, more attention was paid to agriculture. In 1904, an experimental purchase of three island sheep was made, and in 1905 the Greenland Administration opened an experimental sheep-breeding station, with 100 ewes and one fine northern island and 50 ewes from the three islands, at Sallarsuaq. Later, six more ewes were imported, but, otherwise, the whole present stock now stems from the small original stock of 100 ewes. In 1910, the experimental station became the central agency for the breeding of all sheep products. In 1912, a modern slaughterhouse and, in 1913, a small livery and garage were added to the experimental station. Besides other functions, it is the task of the station to train young Greenlanders in sheep-breeding and to set them up in business. As a result of this training program, the first trained Greenlanders in 1920 received a state loan of 2,000 kroner and 100 ewes for the establishment of a sheep farm near the Tunugdliarfik fjord. He is now Greenland's biggest farmer, owning about 750 sheep, a few milk cows, horses, and some other domestic animals. Later on, about 70 young Greenlanders were established in the same way. The loans are free of interest and are to be repaid within 10 years.

With the unexpected great expansion of sheep-breeding, which originally was intended to become only an agricultural sideline, the available natural fodder became insufficient. Therefore,

RESTRICTED

increasing attention was devoted to land reclamation and plant breeding, and in 1926 a plant-life expert was attached to the Julianashaab experimental station.

The climatic conditions for plant breeding are poor. Despite the fact that Julianashaab is situated on the same latitude as the Bergen area, its climate must be classified as sub-arctic because of the cold polar current. The average summer temperature is low, and especially the summer temperatures are too low for the cultivation of plants. Even early varieties of barley generally fail to mature.

Land reclamation is made difficult by the country's mountainous character. Large continuous areas suitable for agriculture are scarce. The ground is steep and everywhere with willow. In practice, therefore, only grass can be cultivated. Some of the imported early varieties of grass, like Fox tail, tendergrass and red fescue, are able to winter, but they disappear after a few years of existence. Existing Greenland grass, like the different varieties of tendergrass, provides the best guarantee for a continual and good yield. In the beginning of 1930, an experimental breeding and reclamation project was undertaken in a swampy area. The experiment showed that such areas are often too cold, and, furthermore, require too much maintenance work. The conclusion was reached that it would be more profitable to clear and cultivate dry and sloping areas. The Greenland sheep owners have cultivated a number of small farms, but thus far have pursued this activity rather sporadically.

Fertilizer experiments were carried out by the experimental station in many localities, and during 1948, the sheep owners used considerable quantities of artificial fertilizer, which resulted in a larger and earlier hay harvest. It has been somewhat easier to interest the Greenlanders in horticulture. Most of the sheepholders and many other people have fairly good gardens, the potatoes, turnips, etc., from which provide a good supplement to the diet.

RESTRICTED

RESTRICTED

The yield of grass and garden plants varies with the climate and the location. Potatoes yield from 7 to 12 times the seed sown, turnips 10-50 tons per hectare, and the Greenland grass mixture yields about 1,000 kilograms per hectare. Spring-sown grain, harvested green for hay or ensilage, gives a very high yield. In recent years, experiments have been made with hotbed and hothouse cultures. It appears that this development could be of great importance, also for North Greenland. Results have been excellent, and many hothouses certainly will be built as soon as the materials situation permits.

The development of sheep breeding is conditioned not only by climatic conditions, but also by the availability of good grazing areas and the possibility of reclaiming bare land. Only a very limited portion of the total land area offers conditions favorable to sheepbreeding. It may be said that about 1/5 of the usable land is located in the interior and surrounding land of the following four fjords: Immedliarsuk, Igaliiko Fjord, Akullarsaq Fjord and Quartoq Fjord. Most of the important sheepbreeding farms are located there. They are listed in the following table.

Important Sheepbreeding Farms

<u>Locality</u>	<u>Number of sheep 1 Nov 1947</u>
Iarssiarsuk and environs	6,405
Ivssaruit N.	ca. 120
Iarssaq	1,325
Igaliko	1,900
Kanisartut N.	565
Soendre Igaliiko	720
Igaluit N.	511
Sydrproeven	219
Lichtenau	360
Akullarsaq	156

Kollorait	205
Stetten	925
Landmunt	656
Summersut II.	108
Maunarsenut II.	364
Maunarsenut III.	75

Places designated by an II. are either newly established or are cultivated by only one or a few families. They have very good chances for growth.

The regional center of sheepbreeding is the Julianashaab District. Figures covering a period from 1925 to 1947 show an extraordinary development:

Number of ewes in the Julianashaab District 1925-1947

1925	1930	1935	1940	1945	1947
1,500	5,691	7,005	9,157	15,203	20,342

The following table shows that about 11,500 sheep are owned by 20 large owners, holding from 200-400 sheep, while 213 owners with stocks from five to 200 sheep own about 1,500 sheep. (The holdings of the breeding station at Julianashaab as well as those of persons owning fewer than five sheep are not included in the following table.)

Sheep Holdings in the Julianashaab District by Owner Groups 1 Nov. 1947

Number of ewes by owner	Number of owners	Total number of sheep
under 25	241	1955
25-50	54	1772
50-100	29	2051
100-200	29	3704
200-300	11	2623
300-400	2	2990
More than 400	2	4809

The 241 small sheep owners are mostly fishermen or hunters for whom sheep-raising is only a sideline occupation. In the Julianashaab District there are, furthermore, about 100 head of cattle, of which about 50 are milk cows, about 90 Iceland horses and colts, about 1,300 fowl, and a large number of sheep-dogs. Domestic animals live

off Greenland fodder, with the exception of the feed, for which fodder must be imported. Of the about 20,000 sheep in the Julianehaab District, almost all belong to private owners. (100 sheep are owned and 1,500 are loaned out by the Julianehaab breeding station.) All slaughter animals are delivered to the Julianehaab station, as the monopoly agency, during the months of September and October. The purchase price is established for each sheep individually. The capacity of the central slaughterhouse at the Julianehaab station proved to be too small, so that in 1956 the veterinary authorities authorized home slaughter, which during the butchering season is supervised by a veterinarian. To meet all requirements, the Julianehaab slaughterhouse will be saved the next few years to the commercial center of Larsang where, in connection with a cannery for sea-birds, a modern slaughterhouse and abattoir will be established with five times the capacity of the present installation. A frozen storage building with space for about 3,000 carcasses will likewise be built.

Three-fifths of theutton butchered is consumed in Greenland, while the remainder and all of the output of sheep wool and skins is exported. At present, there are about four sheep per person in the Julianehaab District and one sheep per person for the country as a whole. This Greenland ratio corresponds approximately to that of the Faroe Islands, while the ratio of the Julianehaab District corresponds to conditions in Iceland.

The future probably will see considerable expansion in the agriculture of Greenland. This applies especially to sheepbreeding. If all available and usable land were to be used, sheepbreeding could be quadrupled. That would mean that the sheep stock in the Julianehaab District would increase to about 75,000 sheep and in the rest of the country to about 10,000. This figure is based on the present form of husbandry, which is based on the sheep monopoly exercised by the

RESTRICTED

Julianehaab station. The handicap in its present form on the one hand guarantees stable production, while on the other hand it discourages the more efficient sheepbreeders from increasing their production. If this handicap were to be changed in favor of a more liberal breeding policy, this certainly would lead to production increases beyond the figures stated above.

In the future, agriculture as a whole might find a much expanded domestic market. The great increase of fishing in connection with modernization of fishing equipment and methods, and an increase in industrial activities will gradually eliminate poor set nets and settlements. The population of these places will shift to centers with larger opportunities and become full-time workers. As such, they will become dependent to an ever-increasing degree on the services of agriculture. Where they formerly provided for their own supplies by fishing, etc., they now will buy meat, potatoes, turnips, cheese, butter, etc., from the centrally located towns. This in turn might result in a more intensive and diversified production. But all that would be dependent on a further improved transportation system, for which, at present, the obstacles are very high.

RECEIVED

Summary of : THE PRODUCTION OF MINERALS IN GREENLAND,
Copenhagen, Grønlands Boges, Vol. II (p. 95-102), 1950.

History of Prospecting

1. The early period of prospecting. The early period of prospecting was characterized by an unsuccessful search for gold and silver. Silver was found at a later date, but was probably brought to Greenland from Europe by the Norsemen. Quartz, Jasper, meteoric and telluric iron were used in primitive tool-making. Magnetite and asbestos were used in the production of several household utensils, etc. The first successful prospector was Hans Blahn, who in 1757 discovered magnetite, asbestos, graphite, coal, and iron ore. H.C. Blahn, in 1765, discovered a "black mountain", presumably a graphite deposit in the vicinity of Holstenborg. Discoveries continued early in 1770 in the Godhavn district and surrounding areas. After the Directorate for the Royal Mineral Trade was established, the German expert, H.C. Pfaff, was employed to analyze the coal deposits and to prospect for minerals. Regular mining operations started in 1770; attempts to produce zinc and iron vitriol from weathered pyrites were made on Storø Island in the Qaanaq district.

2. The period of scientific explorations. The first systematic mineralogical expedition was conducted between 1806-13 by the German H.L. Giesecke and was supported by the Danish Government. He covered the area from Alik on the east coast up to a point north of Upernavik. He was the first mineralogist to visit the pyrolite deposit in the Arsk Fjord and other mineral deposits in the Julianehaab District. In the 1850's H. Rink continued with the location of minerals in Greenland in a series of official and scientific travels. As a result of his analysis and collection of minerals, he gave a

RESTRICTED

description of the cryolite deposit and compiled a survey of Greenland's mineral products.

3. The period of mining experimentation. From 1865 on, the interest in minerals and mining operations in Greenland increased considerably, especially in Denmark and England. An English company mined more than 100 tons of graphite in Langer Island in the Godthaab district. Rich submitted a sample from a newly discovered graphite deposit near Langer on Hoggasak Peninsula to the Danish authorities. A merchant from Aalborg, Jacob H. Lundt, mined some graphite in Langer, and collected graphite samples in Ivigtut and samples of copper ore on Storö Island. His venture later on was financed by the Dane, Westenholtz, and the Englishman, Sir Walter Trevelyan. The Frederik VII. Copper Mine was opened in 1871 on Storö Island (also called Toportarsuaq), but after the mining of about 12 tons of copper ore, the mine was abandoned. The same copper mine was opened in 1872, and in 1873 an English expedition and miner crew managed to extract some copper ore, but after a total of 50 tons had been mined, this mine, too, was given up as exhausted. Lundt and Westenholtz received a concession for mining in Greenland which did not include the mining of cryolite and which was in force until 1885. A lead glance mine, operated by the Englishman, J.W. Taylor, ceased operations after one year of mining lead ore. Lundt transferred his mining rights to Westenholtz, Trevelyan, and Robinson, who in 1857 received a concession for mining and prospecting against payment of a royalty of 5% of the net output to the Danish state. The company never used the concession, but kept it in force just in case something valuable was to be discovered in Greenland. When this period of mining experimentation closed, the mining of graphite and of copper and lead ore had been given up as unprofitable, and only the interest in mining cryolite remained alive.

RESTRICTED

The Mining of Cryolite

Even before Giesecke's arrival in Ivigtut, the cryolite deposit there had been discovered, and the mineral was used for rubbing tobacco.

Simultaneously with the opening of a lead mine, the Directorate of Royal Greenland Trade started the mining of cryolite near Ivigtut on a small scale. For the extraction of the mineral, a process patented by the chemist Julius Thomsen was used, by which cryolite is decomposed by either dry or wet processing with salt of lime. By this process one was able to produce soda, alum, etc. The small quantity of cryolite which the Royal Greenland Trade managed to ship to Denmark was insufficient for factory needs. Therefore, the Danish Government granted Thomsen and Devits the right to mine and ship one shipload of cryolite for a 12% royalty. A first delivery of more than 100 tons of cryolite was made in 1854. In the following years, production increased, despite difficulties, and at last Thomsen and Devits received monopoly rights for the mining and shipping of cryolite in the whole area of Ivigtut. These rights soon afterwards were transferred to the "A/S Kryolith Mine og Handels Selskab" (Cryolite Mining and Trading Company, Inc.), which was founded in 1865.

The Industrial Use of Cryolite.

1. Cryolite in the production of soda. Attempts to use cryolite in the cement industry remained unsuccessful, but greater success was achieved in the manufacture of soap and the enamelling of ironware. Likewise, attempts were made to sell cryolite for use in the production of aluminum, then still a novelty. But for the time being, effort was concentrated on manufacturing soda from cryolite by the Thomsen method. The Oeresund factory, which was set up in 1859, was to be used for the processing of cryolite. The "Oeresund Chemiske

"Fabrikker" (Oeresund Chemical Factories) discontinued the manufacture of soda from cryolite in 1894, when new and cheaper methods of manufacturing soda made operations unprofitable.

2. Cryolite in the production of aluminum. In the meantime, the demand for cryolite for use in the manufacture of alabaster (oral) glass had increased, and use began to be made of the mineral in the enamel and aluminum industry. The aluminum industry later became the largest consumer of cryolite. Cryolite consists of the elements aluminum, sodium and **fluorine**. The aluminum content is of little importance to the aluminum industry, but the low melting point of cryolite, its ability in the melted state to dissolve aluminum oxide, and to conduct electricity are of great value to the industry. After the Oeresund Factory was reorganized to meet the demand of the glass, enamel, and aluminum industries, the Oeresund Factory started the difficult task of purifying the mineral.

The Corporate Structure of the Cryolite Industry.

The mining concession was renewed several times with steadily increasing royalties to the state. On 1 January 1940, the "Kryolit-selskabet Oeresund A/S" (Oeresund Cryolite Company, Inc.) was formed, with the Danish State, the Oeresund Chemical Factories, and the Cryolite Mining and Trading Co., Inc., as stockholders. The mining of cryolite in Ivigtut, as well as its processing and sale in Copenhagen, was centralized in the new company. Only the Pennsylvania Salt Manufacturing Co. in Philadelphia receives the raw cryolite directly from the mine for processing and sale.

Cryolite Deposits.

Cryolite is found near Ivigtut in an egg-shaped formation on top of a granite mass in the Arsuk Fjord. Deposits of cryolite exist also in Colorado and in the Urals, but they are too small for profitable operation. A fourth site was reported during the war to

be in Eastern Siberia; but it is possible that fluorspar used in the manufacture of artificial cryolite was mistaken for cryolite.

The Ivigtut Mine.

1. Dimensions. Cryolite is mined in an open quarry. At present, it is about 200 meters long, 100 meters wide at its widest part and 60 meters below sea level. Recently a reinforced concrete dam has been built to the north of the quarry to permit the mining of large quantities of pure cryolite located beneath the Lusk Fjord.

2. Topography and landmarks. The Ivigtut site is quite unimpressive when approached from the last point of the Lusk Fjord. Situated in a valley and surrounded by steep mountains, its installations are completely hidden. Only after reaching above does one notice the amazing accumulation of 20th century equipment concentrated in that small area of Greenland's wasteland. Silvery water tanks, a high elevator tower (now rapidly disappearing), cable car, a radio station, dormitories, machines shops and multi-colored houses are the landmarks of Ivigtut. But most of all, the mine itself -- a large hole in the earth -- dominates the lay.

3. Mining methods. First of all,^a thick layer of granite has to be quarried. After the granite has dropped into the Fjord, mine workers dismantle the cryolite, which falls to the bottom of the quarry. Up to 1949, it was collected by excavators, loaded into tip carts which went through tunnels to elevators, and up to the surface and the loading site. After 1949, a 500 meter-long tunnel was cut through the mountain; it rises gradually and surfaces to the east of the quarry. In the future, large trucks will transport the cryolite to the surface.

4. Production figures. Up to 1950, a total of about 1 million tons had been mined. During the last pre-war year and during the war, the average yearly production amounted to 50,000 tons. In 1948, only about 18,000 tons were mined.

5. Bohring. Several diamond-bohrings have been undertaken to determine the extent and the purity of the cryolite deposit. A large-scale boring program, with extensive and deep borings, was started in 1948 to find new cryolite deposits. The project will be continued in 1950.

The Copenhagen Cryolite Company

1. Purification Process. The Copenhagen Cryolite Company, Inc. in Copenhagen purifies the cryolite by elimination of its main impurities: iron spar, quartz, lead glance, zinc blende, copper pyrites, and sulfur pyrites. The purification process involves the following steps:

- a) Crushing of the crude cryolite
- b) Repeated treatment with large electromagnets, which removes the weakly magnetic minerals: iron spar, copper pyrites, and zinc blende
- c) The non-magnetic materials are separated according to their specific weight by water and air currents. In this way, the relatively heavy lead glance and sulfur pyrites are eliminated
- d) Fine-grain materials are purified by the flotation process
- e) The remaining quartz and cryolite are subjected to repeated milling and sifting until the coarser quartz can be separated from the cryolite.

2. The finished product and its by-products. Cryolite of 99.2% purity is sold to the aluminum industry, of 96% purity to the enamel industry and the manufacturers of opal glass. Cryocide, a plant insecticide, is produced from cryolite dust. Another by-product is lead glance with some silver content. Furthermore, a concentrate of copper pyrites is sold. Iron spar is sold for the manufacture of pig iron, stained glass, and welding electrodes.

Summarization of: THE NEW LAWS OF GREENLAND.

Copenhagen, Grønlands Bogen, Vol II, (p. 321-334), 1950

On 28 February 1950, the Greenland Commission finished a comprehensive report on the reorganization of Greenland. The report was followed by eight proposed laws that were to form the basis for the future reorganization. While the Law on the Administration of Greenland of 18 April 1925 is a one-package law dealing with all aspects of Greenland life, it was the decision of the commission to deal with the problems in separate laws. On 27 April 1950, eight law proposals were submitted by the prime minister to the lower house of the Danish parliament. The house agreed unanimously on the following eight laws, all of which are dated 27 May 1950:

Law No. 271 on the Provincial Council and the Communal Administration of Greenland

Law No. 272 on the Treasuries of Greenland

Law No. 273 on the Church in Greenland

Law No. 274 on the School System in Greenland

Law No. 275 on the Public Health System in Greenland

Law No. 276 on the Royal Greenland Trade

Law No. 277 on Economic Activity in Greenland

Law No. 278 on Production Loans in Greenland.

1. Law on the Provincial Council (Landsraad) and the Communal Administration (Kommunalbestyrelse) of Greenland.

This law contains a change in the administrative subdivisions of Greenland as established by the Law of 1925, i.e., the old law provided for a subdivision into communes, districts, provinces, and their respective councils, while the new law does away with districts and district councils. The reasons for eliminating the district councils were mainly the following: simplification of administration, avoidance of duplication of effort and of the overwhelmingly Danish composition of the district councils.

The law furthermore abolishes the many small communal councils (kommunerad), which at present amount to about 66 and replaces them by the new communal administrations (kommunalebestyrelser) which are to be established for much larger areas and which are to exercise much wider authority. Paragraph 13 states that the number of communes and their respective areas will be established by royal decree. The reason for this stipulation was to give the provincial council a voice in the determination of the number of communes. In July 1950, the provincial council agreed on a number of 17 communes (kommune).

Besides the centralization of the ~~municipal~~ communal administration, another centralization was effected by replacement of the two provincial councils for North and South Greenland respectively respectively by one provincial council (landsraad) comprising a minimum of 14 members. The law changes the election method for both the provincial council and the communal administrations from indirect to direct elections.

The law does not list the competences of the provincial council and of the communal ~~municipal~~ administrations in detail. This vagueness is explained by the wish to create a flexible system that permits the communal organs to acquire successively greater and greater authority. The following functions will be carried out immediately by the ^{communal} ~~municipal~~ administrations: highway system, fire department, sanitation, and the like. The provincial council has the task of establishing, within the framework of Danish legislation, judicial regulations for the Greenland population and of making recommendations to the government in Denmark with respect to matters affecting Greenland. It is, furthermore, the task of the provincial council to make proposals for budget laws and, in general, to take care of the interests of Greenland before the Danish parliament.

The Greenland Commission has made the proposal to provide, in connection with a future change in the Danish constitution, for direct representation of the population of Greenland in the Danish

parliament. This matter has been referred by the prime minister to the Constitutional Committee of the Danish parliament. But much time will elapse before such a change comes about. Therefore, the law already provides for closer contact between the Greenland provincial council and the Danish parliament. Paragraph 24 provides that in the future the Greenland Committee of the parliament will include two members appointed by the Greenland provincial council.

In order to make it easier for the communal administrations to fulfill their large responsibilities, Paragraph 19 provides for a communal chamberlain (kaemner). The law furthermore anticipates difficulties for the communal administrations arising from the fact that many communes under their jurisdiction are widely scattered. In Paragraph 20, it is therefore provided that the provincial governor (landshoevding), upon recommendation by the communal administrations, may appoint communal commissioners (kommunefoged) who handle communal affairs *on the spot*.

Paragraph 6 states that the provincial governor is the chairman of the provincial council. The establishment of all other positions in the Greenland civil service is left to laws dealing with the appointment of civil servants and with the yearly budget.

2. Law on the Treasuries of Greenland.

The present system of communal, district, and provincial treasuries is being changed into a fiscal apparatus which includes only one provincial treasury (landskasse) and a communal treasury (kommunekasse) for each one of the communes to be established. The provincial treasury will be under the authority of the provincial council, while the means of the communal treasuries will be administered by the respective communal administrations.

In the past, the revenue of the Greenland treasuries had been mainly derived from the following two sources:

1. the purchase tax, paid by the Royal Greenland Trade and calculated at 20% of the amount spent by the Greenland Trade for the purchase of Greenland products from the Greenland population.
2. the 2%-payroll tax, deducted by the Greenland Administration, the Greenland Trade, the churches, and schools of Greenland from the total wages paid to their staffs of public servants, Greenlanders and Danes alike.

With respect to the reorganization, the Greenland Commission felt that at present an income tax was not feasible because the economy of Greenland was still too much of a barter economy, which makes a uniform assessment of income too difficult. Paragraphs 2 and 3 therefore provide that public revenue be derived from an excise tax. So far, especially luxury-type goods have been earmarked for such a tax, e.g., liquor, tobacco, chocolate, coffee, etc. The tax is to be collected by the provincial treasury, which then transfers the receipts to the provincial council. From there, distribution is made to the communes on the basis of their yearly budgets. It is difficult to foresee whether the excise tax will bring in sufficient revenue for the effectuation of tasks assigned the provincial council and the communes, but preliminary calculations seem to indicate that the revenue will suffice.

3. Law on the Church in Greenland.

The laws dealing with the churches and the schools of Greenland are based on the Greenland Commission's proposal to separate the administration of church and school. The titles of curate and first curate up to now have been applied to persons who serve as part-time teachers and part-time church assistants. Even in the future, persons assisting pastors in their functions will be selected from the ranks of the teaching profession, but Paragraph 5 states that in future the designation curate and first curate will be applied only in connection with the ecclesiastical functions of teachers.

The establishment of a dean's court (Par. 7) is something new. This court has jurisdiction only in matters affecting the clergy, but not affecting curates. It is composed of the dean of Greenland and the chairman of the Greenland court of appeal. Sentences of the dean's court may be appealed directly at the Supreme Court (Hoejesteret).

4. Law on the School System in Greenland.

The development of Greenland has led to an increasing demand for education in general and for an expansion of the teaching of Danish in particular.

Paragraph 8 provides that teachers at elementary schools (boerneskol), in order to qualify, must have passed either a teachers' examination at a Danish seminary or a seminary examination of a Greenland seminary.

Paragraph 10 introduces a new feature into the school system. It gives the prime minister the authority to establish, upon recommendation by the school directorate, two separate teaching branches in elementary schools. In one branch (the so-called A-branch), all subjects except Danish would be taught in Greenlandic, while in the other branch (the so-called B-branch), after the end of the second school year at the latest an increasing number of subjects would be taught in Danish until finally all subjects except Greenlandic and religion are taught in that language. It is up to the school inspector to decide which pupils are suited for the Danish branch, but he must negotiate first with the director of the school and must give the greatest possible consideration to the wishes of the parents. The stepped-up teaching of Danish would widen the mental horizon of Greenlanders insofar as Greenlandic literature is very scanty.

Paragraph 11 provides for an important reorganization. The now existing "Hoejskole" school type will be transformed into a "realskole" type, which in a four-year curriculum prepares its students for an examination corresponding to the Danish "realskole" examination.

The provincial council had requested the establishment of an intermediate school (mellenskoole), with Danish as the language of instruction, but the law does not make provision for the immediate establishment of such a school type, but authorizes the prime minister to establish it in the future, but only upon the recommendation of the school directorate and after negotiation with the Danish ministry of education.

Paragraph 16 provides that the "efterskoole" school type will be eliminated from the Greenland school system as soon as the bilingual type of school has been generally established in Greenland.

Paragraph 1-7 contain regulations for the administration of the school system. For the general supervision, a school directorate has been established which is composed of the provincial governor as chairman and the incumbent of the newly established post of director of schools and the dean of Greenland as members.

According to Paragraph 4, West Greenland will be subdivided into school districts. The prime minister, upon recommendation by the school directorate, appoints school inspectors for the respective school districts. The inspectors preferably are to be selected from the ranks of teachers in a district. The institution of school inspectors places the leadership of the school system in the hands of the teachers themselves, while the presence of the dean of Greenland in the school directorate establishes the desired contact with the church.

The law, moreover, makes provision for the possibility of advanced study for promising young Greenlanders.

5. Law on the Public Health System in Greenland.

Paragraph 1 places the supervision of the public health system in the hands of a provincial doctor (landslaege) who is appointed by the king and whose functions are to advise the authorities in Greenland and to carry out inspections in all the medical districts. This supervisory doctor would be freed from all official duties in hospitals in order that he might concentrate on the general health problems of the country.

In view of the very high incidence of tuberculosis in Greenland, Paragraph 4 authorizes the prime minister to select a site for the construction of a sanatorium for tuberculars and a hospital on the coast. But the reorganization and modernization of hospitals alone are not sufficient for the creation of satisfactory health conditions. The construction and improvement ~~xxx~~ program must be accompanied by better education of the population in health matters, by better housing, and by a raising of the general standard of living.

6. Law on the Royal Greenland Trade.

Paragraph 1 of the law assigns to the Royal Greenland Trade the function of providing for the Greenland population all the needed consumers' and capital goods. It was felt that this task could not yet be transferred to private trade channels. In this opinion, private trade would have the tendency to service only large and profitable population centers, while small and far-away places would remain without supplies. But it is the aim to interest private citizens in taking over trading stores.

Besides the supply function, the Royal Greenland Trade has the function -- wherever possible, in conjunction with private firms -- to purchase, process, and export Greenland products. The possibility of including private firms breaks the absolute state monopoly which had been in effect since the times of the Norsemen.

Paragraph 2 stipulates that in future a director, appointed by the prime minister, will be in charge of the Royal Greenland Trade. An administrative council of at least 10 members has the task of participating in the direction of The Royal Greenland Trade and of assisting the director. Private trade and industry associations are to appoint six members to the council. Other members of the council will be: representatives of the population of Greenland, of the parliamentary Greenland Committee, of the minister of finance, and finally the chief of the Department for Greenland Affairs in the Ministry of State (Statsministeriet).

The law furthermore contains, among other things, the provision that retail prices in Greenland are to be fixed on the basis of all costs, i.e., purchase price, transportation, and retailing.

7. Law on Economic Activity in Greenland.

The enactment of the Law on the Royal Greenland Trade made it necessary to change the provision of the Law of 1 Apr 1925 on trapping, fishing, and hunting in Greenland, etc. Since it furthermore was necessary to define the conditions for the participation of private enterprise in economic activity in the future, it became expedient to combine all related regulations into a new law on economic activity in Greenland.

One of the main regulations is contained in Paragraph 10: the right to start and conduct an export activity in Greenland is reserved to Danish citizens, who have to take out a trading concession in accordance with the regulations established in Chapter III of the Law, as well as to Danish, Greenland, and Faroe corporations and limited liability companies, which must have a special license from the prime minister.

Prices of Greenland export products, especially the price of salt fish, have always been subject to considerable fluctuation. If the monopoly administration were not to have carried out a leveling policy by manipulating purchase and sales prices, the pockets of the Greenlanders would have been alternately full and empty. Paragraph 11 guarantees a continuation of this leveling policy and has producers participate in this program by requiring them to put aside the excess income of fat years for the future periods of falling prices. In order to make such a policy possible, Paragraph 11 stipulates the following: export from Greenland will be handled exclusively by a central sales organization. All fishermen sheep raisers, sealers, whalers, etc., residing in Greenland, as well as the export firms mentioned in Paragraph 10, have to sell their export products either directly or through export firms to the central sales organization, which is to handle the export trade from Greenland. Until the establishment of such a central sales organization, the Royal Greenland Trade will act as the central sales organization.

Paragraphs 12-19 contain provisions referring to the licensing of industry, trade, etc. The main prerequisite for the issuance of a license is that the petitioner be a Danish citizen and that he have had at least six months of permanent residence in Greenland at the date of request.

8. Law on Production Loans in Greenland.

In order to stimulate private interest in the economic possibilities of Greenland and especially in projects involving a certain risk, a loan institute is to be established. This institute is authorized to lend capital to individual or cooperative enterprises. The loan activity probably will be channeled mainly in the following directions: installation of better storage facilities in fishing boats, construction and operation of industrial enterprises such as salting plants, drying houses, smoking plants, fillet plants, the manufacture of fish meal and fish oil, ice plants, and cold-storage houses.

The above eight laws which have gone only partly into effect, are only a starter for a thorough reorganization. They will be followed by many laws, e.g., by a law on the administration of justice and a penal law.

SECURITY INFORMATION

RESTRICTED

CIA

FOREIGN DOCUMENTS DIVISION



October 1951

50X1-HUM

Germanium in Coals

V. M. Ratynskiy. Trudy Biogeokhimicheskoy Laboratorii, No 8, pp 181-223, 1946. Moscow. 1946.



50X1-HUM

[This report has not been edited
or prepared for publication]

RESTRICTED

RESTRICTED

Germanium in Coals - V.M. Ratynskiy

TABLE OF CONTENTS

	Page
I. Introduction.....	183
II. Survey of the Literature.....	183
1. A Short Geochemical Synopsis of Germanium.....	183
2. Summary of Data on Germanium of Foreign Deposits..	184
3. Summary of Data on Germanium in Coals of the USSR.	188
III. Methods for Determining Germanium.....	194
1. Survey of Methods Applied in Determining Germanium	194
2. Method of Chemical Determination of Germanium.....	196
3. Method of Spectrum Determination of Germanium.....	202
IV. Results of the Analysis and Consideration of Them.....	206
1. Description of the Analyzed Material.....	206
2. Description of the Khumarin Deposit.....	207
3. New Analytical Data on Germanium in Coals.....	208
4. Survey of the Hypotheses on the Origin of Germanium in Coals.....	214
5. New Data on the Distribution of Germanium in Coals.....	215
V. Conclusions.....	221
Bibliography.....	222

RESTRICTED

RESTRICTED

GERANIUM IN COALS

V. M. Ratynskiy

I. INTRODUCTION

The ashes of many mineral coals, as shown by studies of recent years, and also earlier isolated indications, contain rare elements in greater quantity than other sedimentary rocks (Howarth, 1928; Jorissen, 1895-1896; Jensch, 1887; North and Howarth, 1929). The degree of concentration of the individual rare elements varies. The concentration of germanium in coals reaches 1600 (Goldschmidt, 1933), which gives its study special interest, both theoretically and practically.

The content and composition of the ashes of mineral coals arouse great interest, but from works devoted to the question of the origin of the ash, it is possible to indicate only the work of Lessing (1926), which affords only a preliminary scheme of the manner in which the ash is formed. To approach the question of the origin of ashes of coal in the example of germanium, as representative of the rare, diffused elements, is extremely opportune.

The source for the industrial extraction of germanium at the present time is sulfide ores, in which the concentration of germanium is very insignificant. Thus, for example, the average content of germanium in zincblendes of the Soviet Union does not exceed 0.01 percent (Abramov and Rusanov, 1928). During the processing of sulfide ores, the germanium is concentrated in various kinds of sublimates, chiefly Cottrell crystal, in which its content reaches 0.06 percent (Syrokonskiy, 1940). Coals of a number of deposits, and also

RESTRICTED

RESTRICTED

many products of the processing of coal, which are waste products in the majority, may be a raw material, which is significantly richer in germanium than Cottrell crystals.

Starting the study of germanium in coals, we set ourselves the task of giving, if possible, a complete survey of all work leading in the given direction, and to approach the decisive question regarding the nature of the accumulation of germanium in mineral coals that may be of profit, besides of scientific significance, and for the practical extraction of germanium from coal of native deposits.

II. SURVEY OF THE LITERATURE

1. A Short Geochemical Synopsis of Germanium

In 1871, D. I. Mendeleev indicated the possibility of the existence of a new, at that time still unknown, element, related to silicon in its physico-chemical properties. This unknown element was called ekasilicon (germanium) by D. I. Mendeleev. In 1886, ekasilicon was discovered by Winkler and described under the name of "Germanium".

Germanium is a typical element of diffusion. No more than 15 to 20 years ago it was considered one of the rarest elements, a fact that can be graphically represented by comparison with geochemical summaries, in which its rating increased from 10^{-9} to 10^{-4} percent. In 1924, Clark and Washington calculated the percentage of germanium in the Earth's crust to equal $n.10^{-9}$ percent; in the years 1925-30 V. I. Vernadskiy calculated it to equal $<10^{-8}$ percent, and in 1937 V. M. Goldschmidt calculated it to equal 7.10^{-4} percent.

RESTRICTED

RESTRICTED

On the basis of the works of Ya. Papiish (1927, 1928, 1929) and V. M. Goldschmidt, chiefly, the geochemistry of germanium appears in the following general outline. The basic mass of germanium is dispersed, owing to the proximity of ionic radii of the tetravalent positive germanium $0.44 \text{ \AA}$ and the tetravalent positive silicon $0.39 \text{ \AA}$, in the form of isomorphic admixtures in different silicate rocks. Germanium was detected by V. M. Goldschmidt in almost all rocks and minerals analyzed. The average sample from 11 gabbroic rocks contained <0.0005 percent germanium dioxide. The average sample of basalt and nephelinic syenites also contained <0.0005 percent. The average sample from 14 granites was 0.0005 percent germanium dioxide. The quantity of germanium in basic volcanic rocks is lower on the average than in granite rocks.

Germanium is always present in magmatic sulfide ores in quantities close to the percentage of germanium in basic silicate rocks.

An appreciable accumulation of germanium in comparison to its average percentage in granites is found in rocks and minerals of stannate-stone pneumatolysis and especially in sulfides of hydrothermal origin. Owing to the proximity of radii of germanium and zinc, germanium forms an isomorphic admixture with zinc sulfide in relatively greater quantities than with other sulfides. The highest concentration of germanium, up to 0.01 -- 0.1 percent, is recorded by V. M. Goldschmidt for zinc blendes of mesothermal and epithermal origin. During the erosion of magmatic rocks, the basic mass of germanium is converted in the resulting sedimentation.

The percentage of germanium in marine and terrestrial deposits differs little from the percentage in granites. According to

RESTRICTED

RESTRICTED

V. M. Goldschmidt (1933), the average sample from 36 argillites contained 0.001 percent germanium dioxide. A mixture of clays from 18 samples contained 0.0005 percent. The red, deep-water clay of the collection of the Chelendzher expedition contained 0.0005 percent. Different bauxites contained 0.0005 percent; and kaolin 0.0001 percent.

In sedimentary iron ores the percentage of germanium is somewhat higher than in argillaceous sedimentation -- nearly 0.001 percent. The highest concentration of germanium, up to 7-8 percent, is found in argyrodite, canfieldite, germanite, ultra basic rock, and kayeksite. These minerals are, chiefly, sulfides of silver, copper and lead, and are a mineralogical rarity.

In 1930, V. M. Goldschmidt detected the concentration of germanium in mineral coals (1930). The analysis of numerous samples of coals of different deposits showed that the percentage of germanium in a number of coals averages 0.001 percent, in individual cases reaching 0.01 percent. In ashes of coal the concentration of germanium in comparison with the original coals clearly is increased, amounting to 10 percent, as will be shown below.

2. Summary of the Data on Germanium in Coals of Foreign Deposits

V. M. Goldschmidt (1930-1933) investigated a number of German and English coal deposits. (Table 1).

Together with the ashes of coals Goldschmidt (1933) also analyzed the ashes of lignite and peat. Some germanium was found in the ashes of lignite and peat, but it was significantly less than in coals (Table 2).

- 4 -

RESTRICTED

RESTRICTED

Goldschmidt calculated that the germanium content in coal is combined for the most part with the coal itself and only in an insignificant portion with admixed shale, and therefore the lower the total quantity of ash the higher the percentage of germanium in the ash.

An analysis of several samples of different ash content, taken from one stratum in Silesia, gave the following results (Table 3).

In 1895-1896, Jorissen, analyzing rare elements in coals, carried out an analysis of the volatile portions of the ash obtained by steam distillation, and determined the concentration of a number of elements; however, germanium was not detected among them.

V. M. Goldschmidt, simultaneously with the first determinations of germanium in coals, in 1930 carried out determinations of germanium in volatile ash, and also in ash of soot from chimneys of the furnaces of the central heating of the Gottingen Mineralogical Institute. The percentage of germanium ranged from 0.01 to 0.1 percent.

RESTRICTED

RESTRICTED

Table 1

Percentage of GeO_2 (in %) in Coals
(according to Goldschmidt, 1933_{1,2})

Ashes of Coal	Ash	GeO_2
Coal. Waldenburg, Lower Silesia.....	2.7	0.001
" Hubengrube, Neurode, Lower Silesia.....	2.8	0.01
" Fuchsgrube.....	3.0	0.1--0.01
" Besweiler, Aachen District.....	3.1	0.01--0.001
" Wattenstein, Ruhr Region.....	6.7	0.01
Poor Anthracite Coal. Langenbram, Ruhr Region....	2.3	0.01
Bituminous Coal. Tilsen, Hamborn.....	3.2	0.01
Gaseous Coal. Brassert, Westphalia.....	1.4	0.05
Coal. Hartley, New Castle.....	1.2	1.0
" " " "	1.1	1.0--0.1
" " " "	0.9	1.6
Anthracite. Langenbram, Ruhr Region.....	2.3	0.01
Duren. Brassert, Long-flame Coal,		
Bed No. 7, Westphalia.....	1.9	0.01
Clarein. Brassert, Westphalia.....	0.9	0.1
Duren. Zollverein, Group of Stratified Deposits...4.0		0.01
Vitrain-Clarein. Same as above.....	1.7	0.1
Coal. Karsten-Tsentrum Mine, Upper Silesia.....	2.0	0.1--0.01
Coal. Neyrode.....	1.6	0.2
Coal. Samples from the same strata and pits.....	4.3	0.05
Coal. "nother sample.....	14.1	0.01
Coal. " "	27.5	0.001--0.01

6
RESTRICTED

RESTRICTED

Table 2

Percentage of GeO_2 in the Ash of Peat and Lignite (in %)

Ashes of Peat and Lignite	% of Ash	GeO_2
Peat dust, Bremen, Oldenburg.....	2.3	0.001--0.005
Peat, Neustadt, Hannover.....	1.6	0.001--0.005
Lignite, Lake Zurich, Switzerland.....	15.0	0.65
" Wallensen, Hannover.....	3.5	0.0005
" " "	2.3	0.01--0.005
Lauchhammer, Nieder Lausitz.....	7.6	0.01
Wolff-Galbe, Halle-Magdeburg.....	7.7	0.0005
Belen, Leipzig.....	13.8	0.005--0.01
Jacob Mine, Stassfurt.....	8.6	0.001
Ericka Mine, Zonftenberg.....	5.4	0.001
Emma Mine.....	8.9	0.005
Helmsstadt.....	9.9	0.005
Main Weser, Kassel.....	3.4	0.03
Alexandra Mine.....	2.8	0.0005
Turnish Mine, Rhineland.....	4.8	0.0005

7
RESTRICTED

RESTRICTED

Germanium was discovered also in coal tar and the ash of coal tar.

Walter Fuchs conducted an investigation of rare elements in the ashes of lignites of Germany in connection with the production of activated carbon, and also to investigate the possibility of utilizing the ash of lignite as a fertilizer (Fuchs, 1935). The analysis was conducted on 45 chemical elements, 25 of which were found in the ash of lignites, among them germanium. The author does not give a quantitative determination of the amount of germanium, only indicating traces of this element. The conflicting numerical data of W. Fuchs on a whole series of elements with our data and that of a number of other authors compels us to desire verification of W. Fuchs' data.

Table 3

Percentage of GeO_2 in coals with different ash content (according to Goldschmidt, 1933)

Samples of ash	GeO_2
With 1.6%	0.2
" 3.6%	0.1

In 1935, G. Morgan and G. Davies conducted experiments to obtain germanium from the ash of Northumberland coal by the method of distillation of germanium in the form of tetrachloride (Morgan, 1935, 1936). Northumberland coal was selected for the experiments as it contains a large quantity of germanium (up to 1 percent). In the process of the investigation it became clear that the amount

RESTRICTED

of germanium in the different samples of coal fluctuates greatly. The variation in content of germanium G. Morgan explains as a change in content of germanic minerals.

G. Morgan advanced the hypothesis that germanium is found in coal partially in the form of sulfide, partially in the form of oxide, but gave no verification for his theory.

Continuing the experiments to obtain germanium from the ash of Northumberland coal, G. Morgan and G. Davies encountered two difficulties. The first is the fact that germanium is not uniformly distributed in coal, coal from different pits containing different amounts of germanium, and the second is the fact that oxide and sulfide of germanium are volatile, and during combustion of a large quantity of coal it is impossible to maintain conditions for complete oxidation to germanium dioxide.

G. Morgan and G. Davies conducted experiments on the losses which take place during combustion of coal in reduction conditions. During the experiment a slow current of air was passed over the layers of coal with a known content of germanium, which is heated in a quartz tube at 1000 degrees. After 12 hours the amount of germanium fell to 60 percent (Morgan and Davies, 1937).

For an explanation of the amount of germanium loss during combustion of coal in oxidation conditions, the germanium in a number of coals and their ashes was determined. Combustion was carried out at 750-800 degrees and with complete access of air. In passing the ashes of chimneys were analyzed. The results are cited in Table 4.

9
RESTRICTED

RESTRICTED

Table 4

Loss of Ge during Combustion of Coal and Soot (in %)
(according to Morgan and Davies, 1937)

Coal or Volatile Ash	Ash Content	Ge		Loss of Ge during Combustion
		in coal or soot	in the ash of coal or soot	
Coal piles of South Lester	12.2	0.0086	0.31	42
Coal piles of Staffordshire	20.2	0.0070	0.023	34
" " " "	11.15	0.0051	0.030	31
" " " Northumberland	2.4	0.0065	0.10	60
Coal company of New Castle	1.8	0.0065	0.15	61
Volatile ash from the equipment of a gas plant	38.1	0.540	1.23	13.4
Volatile ash from a generator	32.2	0.171	0.461	13.2
Ash of waste gas from a boiler	68.14	0.694	0.972	4.6

On the basis of these experiments it is apparent that the loss of germanium takes place during combustion of each of the analyzed materials at the time of the simultaneous oxidation conditions. The amount of loss can be compared with the quantity of organic material in the incinerated sample.

The study of numerous samples of chimney ash, obtained by G. Morgan and G. Davies from different gas companies, which used coals

RESTRICTED

from Durham, Northumberland, South York, South Wales and a number of other coal deposits of England, showed a significant concentration of germanium (and gallic oxide) in the volatile portion of the ash. During the analysis of 72 samples, germanium was found in 68 of them in amounts varying from a trace to 1.40 percent. The average content of germanium in the 72 samples was 0.28 percent.

G. Morgan and G. Davies demonstrated that small samples of the volatile portion of the ash frequently do not reflect all of the material; for example, the sample containing 0.4 percent germanium and 1.6 percent gallic oxide. A large number of analyses conducted on material selected from three tons of ash submitted by gas companies at the disposal of the authors, showed only 0.23 percent germanium and accordingly 0.30 percent gallic oxide.

Of significant interest is the sample obtained from crystals of the precipitation of the ash, through which the gas of the producer passed, scrubbed by streams of water. Together with a significant quantity of germanium (and gallic oxide), this sample contains silver and thallium in a quantity greater than usually encountered in chimney ash.

The examination of volatile ash from chimneys of steam boilers revealed a low percentage of germanium (and gallic oxide). G. Morgan and G. Davies explained this by the fact that fine particles of these metals are swept through by the draft, so that a large part of the material is sustained in the atmosphere.

G. Morgan and G. Davies emphasized that all of the ashes of gas plants contain both germanium and also gallic oxide, whether or not they used coal.

//
RESTRICTED

RESTRICTED

Besides these metals, small quantities of silver, indium, thallium, cerium, tantalum and lanthanum, and sometimes vanadium also are often found there. Not being an important source for obtaining the latter metals, chimney ash is an extremely valuable raw material for the extraction of germanium and gallic oxide. There is every basis for assuming that in case of need, with certain changes in plant conditions, a material can be produced which will be richer in this metal than that now available.

T. Cook (1938) conducted large investigations, chiefly with the volatile portion of the ash of Australian coals.

The majority of the investigated ashes were from Permian carbonaceous coals of Australia, which are, according to P. I. Stepanov, bituminous coals (Stepanov and Mironov, 1937).

In the ashes of Australian coals, the content of germanium (and gallic oxide) was found to be significantly lower than in the ashes of English coals which were examined by G. Morgan and G. Davies, but the presence of both of these elements was established for almost all samples.

The ashes which were richest in germanium seemed to be the Permian carbonaceous coals of New South Wales, obtained from the South Australian Gas Company. In chimney ash from waste gas in the vertical converter was found 0.034 percent GeO_2 and 0.084 percent Ga_2O_3 . In the corresponding ash from the horizontal converter was found 0.041 percent GeO_2 and 0.073 percent Ga_2O_3 .

Ash from the chimneys in Lancashire, during the combustion of coke oven gas in boilers, contained 0.004 percent germanium dioxide. Samples of residual liquid from the distillation of ammonia

12

RESTRICTED

RESTRICTED

did not contain germanium.

Samples of ash from Permian carbonaceous coals of South Australia, taken from the base of factory stacks, contained only 0.007 percent germanium dioxide and 0.002 percent gallic oxide).

The ash of coal of the Mesozoic Period from Tasmania contained 0.005 percent germanium dioxide (and only traces of gallic oxide).

Three samples of ash from chimneys of boilers, heated with lignite of the Tertiary Period, revealed only traces of germanium (and gallic oxide).

Interesting calculations on the rate of diffusion of germanium, which takes place during the combustion of coal, were carried out by G. Morgan and G. Davies (1937₁, 1937₂).

If only 100 million tons of coal, with a germanium content, are extracted yearly in Great Britain, and the coal contains not more than 0.002 percent germanium, and only half as much gallic oxide, then consequently, the 2000 and 1000 tons of these metals, respectively, which could be utilized, at the present time either are dispersed in the atmosphere or are discarded as useless in the form of useless ashes.

3. Summary of the Data on Germanium in Coals of the USSR

The first investigations of germanium in the coals of the Soviet Union were started by the Mineralogical Laboratory of the VIMS in 1933. It conducted a systematic study of the western part of the Donets Basin, where in a number of samples a significant concentration of germanium was discovered. The eastern anthracite re-

RESTRICTED

RESTRICTED

tion was not examined.

Data on the coals of the Donbas with an increased content of germanium is shown in Table 5 (Zil'bermintz, Kusanov and Kostrikin, 1936).

Table 5

Coals of the Donbas with Content of Ge 0.1 - 1 percent
(according to Zil'bermintz, 1936)

Region	Ge		Region	Ge	
	Ash in the	% Ash %		Ash in the	% Ash %
Lisichanskiy	5.36		Lisichanskiy	1.44	
	1.40				
	4.18				
	1.94				
Almasho-Mar'yevskiy	3.98	Closer	Almasho-Mar'yevskiy	3.91	Closer
	2.11	to		8.12	to
	2.89	1%			0.1%
	2.27				
Stalinskiy	4.35		Stalinskiy	1.50	
	3.46			2.25	
	2.42			1.52	
			Makeyevskiy	2.29	

In 1935 an investigation of germanium in the coals of the western part of the Donets Basin was carried out on material from samples of average deposits, on products of coke by-product processing, on samples of ash, soot and slag (Zil'bermintz, 1936).

The average deposit samples were selected according to the existing principles of sampling coal beds. The determination of germanium was carried out twice for each sample. The results of the investigation are shown in Table 6. Inasmuch as the average deposit samples were taken at mines from which samples were taken in 1933, and the distance between the points from which the samples of 1933 and 1935 were taken is small, the content of germanium in the samples of the 1933 collection is shown simultaneously in the table. The line over the figure indicates, according to V. A. Zil'bermintz (1936), the closeness of the determination to the given figure.

14 RESTRICTED

RESTRICTED

The investigations which were carried out on samples from average deposits are of great interest and permit the conclusion to be drawn that the increased content of germanium in individual seams can be traced for a known distance.

The data of the analyses of lump samples and average layer specimens do not coincide in the majority of cases; the average specimens, as a rule, contain less germanium. Such a variance V. A. Zil'bermintz explains as an irregular distribution of germanium in the different quantities of coal, but this by no means explains from our viewpoint the coordination of the collection of samples to quantities with a concentration of germanium.

Table 6

Content of Ge in average Layer Samples of the Donets Basin (in %)
(according to Zil'bermintz, 1933)

Mine	Shaft	Samples of 1933 Collection		Layer Samples of 1936 Collection		
		Ash %	Ge %	Ash %	Ge %	In Ash %
No 6/14-Shohaglovka	Fifty-fourth k ₈	1.52	1.0-0.1	6.50	0.1-0.01	0.1-0.01
"	"	0.34	0.1-0.01			
	Almaz l ₃	2.49	1.0-0.1	2.14	1.0-0.1	1.0-0.01
No 1/2-bis-Novoguykino	Arturovskiy k ₈	---	---	6.88	0.01	0.1-0.01
The same	Almaz l ₃	---	---	4.41	0.1-0.01	0.1-0.01
No 10-bis-Stalino	Aleksandr m ₂	2.42	1.0-0.1	3.92	0	0.01
No 8 - Stalino	Koksovyi l ₄	----	----	7.40	0.01	0.01
"	Arturovskiy k ₈	----	----	3.22	0.01	0.01
No 5-pos. Trudovskiy	Lidiyevskiy l ₄	12.15	1.0-0.1	9.10	0.1-0.01	0.1-0.01
No 5-pos. Trudovskiy	Semenovskiy k ₈	2.17	0.001	8.80	0.01	0.01
No 7-pos. Trudovskiy	Aleksandr m ₂	3.20	1.0-0.1	6.66	1.0-0.1	0.1-0.01

15 RESTRICTED

RESTRICTED

Mine	Shaft	Samples of 1933 Collection		Layer Samples of 1935 Collection		
		Ash %	Ge %	Ash %	Ge %	in Ash %
No 4-Maksimovka	III Kamenskiy k ₅	8.47	0.001	5.12	1.0-0.1	1.0-0.1
		2.58	1.0-0.1			
" "	Beral' k ₅	6.12	1-0.1	6.99	0	> 0.01
		2.55	---			
No 22-Golubovka	IV Golubovskiy l ₄	3.21	1.0-0.1	7.10	<0.01	>0.01
		1.33	0.001			
No 1-bis-Krivo- rozh'ye	Arshinka k ₅	0.51	----	2.80	0.1-0.01	0.1-0.01
		2.27	1.0-0.1			
No 4/2-bis-Imaino	III-Kamenskiy k ₅	2.11	1.0-0.1	5.58	1.0-0.1	0.1-0.01
" " "	Atan l ₃	3.89	1.0-0.1	10.04	0.1-0.01	0.1-0.01
Im. Mel'nikova	VII Lisichanskiy k ₅	5.29	1.0-0.1	3.00	0.1-0.01	0.1-0.01
" "	" "	2.44	1.0-0.1	6.50	0.1-0.01	0.1-0.01
" "	" "	1.91	0.001	3.05	0.1-0.01	0.1-0.01
		---	1.0-0.1			
Im Pukhovishka	III Lisichanskiy k ₅	---	-----	11.24	<0.01	>0.01
" "	VII Lisichanskiy k ₅	---	1.0-0.1	3.07	<0.01	0.1-0.01

A significant quantity of coal from the Donets Basin is treated for reprocessing for benzol plants, in connection with which determinations of germanium in various products which were obtained during such processing, were carried out (Table 7). At the same time slag and flue dust (volatile ash), obtained during combustion of those coals, were examined (Table 8).

RESTRICTED

Table 7

Content of Ge in the Products of Donbas Coke by-product Plants (in %)
(according to Zil'bermint, 1938)

Plant	Mine		Coke		Coal-Tar		Pitch	
	Ash	Ge in Ash	Ash	Ge in Ash	Ash	Ge in Ash	Ash	Ge in Ash
Kadiyevka, plant No 1 (1000 tons/day)	9.30	0.1-0.01	11.17	0.1-0.01	0.32	> 1.0 (0.95%)	0.02	> 1.0 1.0 (0.89%)
Makayevka, plant No 5 (2000 tons/day)	8.84	<0.01	9.98	<0.01	0.62	>1.0	0.35	>1.0
Kutshenkovs, plant No 2 (3000 tons/day)	6.82	0.1-0.01	12.95	<0.01	1.39	>1.0 (1.2%)	0.24	1.0-0.1
Smolyanka, plant No 9 (800 tons/day)	8.07	<0.01	10.49	<0.01	0.65	>1.0 (0.84%)	0.012	>1.0

1 Data by chemical analyses.

Table 8

Content of Ge in Slags and Flue Dust from Boilers in Mines
and the Severo-Donets GRES (in %)

Place of Collection	Ash content of material	Ge in the Ash	
		1 sample	2 sample
Mine No 6/14-Shoheglovka 131 kg	slag 67.20	---	<0.01
" No 1 " "	flue dust ---	0.1-0.01	0.1-0.01
" No 10-bis-Stalino m ₂	" " ---	0.1-0.01	0.1-0.01
" " " "	" " ---	<0.01	<0.01
" No 5 im. Trudovskiy 14 kg	slag 92.50	---	0
" " " "	flue dust ---	1.0-0.1	0.1-0.01
" No 7 " m ₂ m ₃	" " 77.03	1.0-0.1	0.1-0.01
" " " "	" " ---	0.1-0.01	0.1-0.01
No 1-bis-Krivorosh'ye	" " ---	0.1-0.01	0
" No 4/2-bis-Irmino	slag 56.31	---	0

(cont. next page)

- 17 - RESTRICTED

RESTRICTED

Table 8 (cont.)

Place of Collection	Ash content of Material	As in the Ash	
		1 Sample	2 Sample
Mine No 4/2-bis-Irmamo	flue dust ---	0.1-0.01	<0.01
" im. Mel'nikova 1314kg	slag 78.37	---	0
" " " "	flue dust ---	0.1-0.01	0.1-0.01
Sev. Donets GRES 114kg	" " 70.89	0	<0.01
" " " "	" " 88.10-	0	0
" " " "	slag 87.81	<0.01	<0.01

RESTRICTED

RESTRICTED

The line over the figure indicates, according to V. A. Zil'bermintz (1936), the closeness of the determination to the given figure.

In addition to the western part of the Donets Basin, V. A. Zil'bermintz (Zil'bermintz, Rusanov and Kostrikin, 1936), studied the deposits of the Caucasus -- Tkviul'skiy, Tkvarchel'skiy and Xumarinskiy -- and also analyzed the museum specimens of a number of deposits (Tables 9, 10).

Table 9

Coals of different Deposits in the USSR with a Content of 0.1 - 1 percent, on the basis of the Ash (according to Zil'bermintz, 1936)

Name of Deposit	Content of Ash, %
Medvezhiya Island.....	-----
Right Bank of Necha River.....	-----
Vin' River (right tributary of the Necha River), 0.5 kilometers above the mouth.....	-----
Right bank of the Mal'yy Syn' River.....	-----
" " " " Pechora River, 1 kilometer above the Pechora River.....	-----
Left Bank of the Necha River, from sandstone.....	-----
Right Bank of the Necha River, from a deposit in sandstone.....	-----
Mal'yy Syn'ha.....	-----
^{ash} Bankir SSR, Tanalyk River, near Ishmukhametobaya.....	4.53
Right bank of the Severnaya Dvina.....	-----

RESTRICTED

Name of Deposit	Content of Ash, %
Verkhne-Sos'vinskiy Rayon, Yany-Man'ya River.....	5.87
" " " Bol'shaya Sos'va River, below	8.32
the mouth of the Man'ya.....	2.52
Bol'shaya Leplya River.....	1.79
Bol'shaya Leplya River (another sample).....	4.78
Yuzhnyy Ural, Manyt River (tributary of the Ura River)...	4.58
Khumara (four samples).....	-----

In the deposits enumerated below, germanium is contained, according to V. A. Zil'bermintz (1936), in a quantity of from 0.01 percent to 0.1 percent: 1) Crimea, Beshuy, 2) Ural, Gubakha, 3) Spitzbergen, 4) Tsaganskiy deposit (two samples), 5) Borovichi, 6) Akhalsikh, 7) Cheremkhovo, 8) Ishmukhametovo, 9) Shibayevo, near Aktyubinsk, 10) Necha River, 11) Pechora, Ust'-Vukt, 12) Left bank of the Pechora, 13) Right bank of the Pechora, 14) Nyays' River, from a moraine (three samples), 15) Shoniol River, 16) Tol'ya River (two samples), 17) Yany-Man'ya, 18) Lopsiya River, 19) Bol'shoy Leplya River, 20) Khumara (seven samples). These deposits were studied (with the exception of Khumara) through a single museum sample.

RESTRICTED

Table 10

Content of Ge in Individual Samples of South Yuzhnyy Ural
Deposits (in %)
According to Zil'bermints, (1936)

Deposit	Ge in the Ash	Deposit	Ge in the Ash
Ishimkhametovskiy	0.1-0.1	Surakayskiy	0.1-0.01
Samarakiy	1.0-0.1	Karatashtinskiy	1.0-0.1
Buryubayevskiy	1.0-0.1	Shibayevskiy	0.01-0.1
Kil'berdinskiy	0.1-0.01	Butyr-Bar-Batyarskiy	1.0-0.1
Mamytskiy	0.1-1.0	Kumakakiy	1.0-0.1
Karaganskiy	0.1-0.01	Iletskiy	1.0-0.1
Yermolayevskiy	1.0-0.01		

21 RESTRICTED

RESTRICTED

It should be noted that there is a concentration of germanium in the individual samples of lignite of a number of small deposits in the South Yuzhnyy Ural, which were examined, in the majority of cases, through single samples; see Table 10.

Several of the deposits listed could be of significant interest as a result of further study of them.

V. M. Kostrikhin (1939₂) studied the content of germanium in the coals of the Urals, examining 244 samples from the following regions:

Deposits of the Pechora River basin.....	62 samples
" " " Tabola " ".....	" "
Bogoslovskiy Deposits.....	" "
Kizelovskiy "	" "
Chelyabinskii "	" "
Poltavo-	
Bredinskii "	" "
Remaining Ural Deposits.....	" "

Among the 244 samples, an increased content of germanium of 0.1 percent -- 1.0 percent is found in 34 samples, the majority of which are lignites (see Table 11).

Table 11

(see next page)

RESTRICTED

RESTRICTED

Table 11

Ural Coals with Ge Content of
0.1-1.0%
(according to Kostrikin, 1939)

Deposit	Description of Sample	Content of Ash, %
Peghora River	Black Lignite	---
Nesha River	the same	---
" "	" "	---
" " Ruchey Vona	" "	---
Malyy Synya River	" "	---
" " "	" "	---
Kosy-Yu " (from veins)	" "	4.9
" " (from nookets)	" "	5.0
SoH'va "	Brown coal	---
" "	Black Lignite	2.32
Yany-Mun'ya "	" "	---
Tol'ya "	" "	6.16
Nyais' "	" "	5.7
Leplya "	" "	1.85
" "	" "	4.78
" "	" "	2.98
Kamenskiy Plant	" "	13.60
Yermolayevskiy	Brown Lignite	2.63
"	the same	5.46
Ay-Yula Cree, tributary of Tanalyk River	Black Lignite	5.62
Tanalyk River, Ishmukhametovskiy Deposit	" "	3.18
Tanalyk River, Samarskiy Deposit	" "	4.28

(cont. next page)

28 RESTRICTED

RESTRICTED

Table 11 (cont.)

Deposit	Description of Sample	Content of Ash, %
Tanalyk River, Buryubiyevskiy Deposit	Black Lignite-	3.90
Karagashty River	Brown Coal	11.12
Kurasha River	Black Lignite	2.44
Kumak River (eastern pos. of Orak)	the same	7.59
Ugyn River, Ilatskiy Deposit	" "	14.96
Mamyt River, right bank	" "	6.48
" " " "	" "	4.56
Mamyt River, left bank	" "	4.32
" " " " (from river-bed)	" "	7.47
Aktyubinsk Oblast, Shibiyskiy Settlement	Brown Coal	7.06
Aktyubinsk Oblast, Kutyr-Datyarskiy Settlement	Black Lignite	---

RESTRICTED

RESTRICTED

From the ash of a number of samples the extraction of germanium was carried out by the method of distillation from hydrochloric acid solution as the chloride (Table 12).

Table 12
Results of the Extraction of GeO_2 from Ash of Ural Coals
(according to Kostrikin, 1939)

Deposit	Ash %	GeO_2 in given spectrum of the analysis on ash, %	Extraction of GeO_2 from 100 g. of ash, v. e.
Yermolayevskiy	5.46	0.1-1.0	0.180
Ishukhametovskiy	3.18	---	0.850
Karaganovskiy	4.40	---	0.340
Kurashinskiy	11.42	0.01-0.1	0.023
Mamyskiy	4.32	0.1-1.0	0.178
"	6.48	---	0.280
"	8.31	---	0.170
Samarakiy	4.28	---	0.380

The germanium dioxide given off was examined for purity by the spectrum method and appeared to be only weakly contaminated.

Experiments on a considerably broader scale were carried out by V. M. Kostrikin to extract germanium from the tarry residue of the benzol plants of the Donbas (1939₁).

As demonstrated in the investigations carried out, even in those cases when germanium was not detected during analysis in the ash of furnaces operated for coking, it usually existed in significant concentration in coal tars and coal-tar products. Simultaneously with germanium in the ash of coal-tar products a concentration of gallic oxide up to 0.11 percent was discovered. The ashes of coal-tar products, obtained from the coke by-products plants of the

RESTRICTED

RESTRICTED

Donbas, notwithstanding the significant variety in the composition of the coking furnaces, is characterized by a high content of germanium. The ash of coal-tar products, obtained during the coking of Kuzbas coals, is characterized by a low content of germanium. The ash of the coal-tar products of the Magnitogorsk coke by-products plant is in an intermediate state.

V. M. Kostrikin links the volatilization of germanium from the coking chambers and its concentration in tars and coal-tar products with the content of sulfur in coals. Not having solved the influence of sulfur on the volatility of a germanium compound, we consider as more probable the relation of the germanium content in coal-tar products to the content in the original furnace, which is verified by our data on the low content of germanium in the coals of the Kuznets Basin (Table 20).

On the ash of coal-tar products, secured in the form of waste at coke by-products plants of the Donbas, experiments were carried out for the practical extraction of germanium.

For the ashing of coal-tar products, an experimental muffle furnace was constructed with a temperature range of 650-700 degrees, from which was obtained nearly 60 kilograms of ash of coal-tar products. The percentage of germanium in the ash of the coal-tar products, obtained from the experimental furnace, was found to be only 0.29 percent (Kostrikin, 1939), at the same time that the content of germanium was estimated at not less than 1.0 percent, at the time of ashing coal-tar products for analytical purposes; see Table 7 (Zil'bermintz, 1936). So large a loss of germanium during the ashing of coal-tar products must be due to the constructional

RESTRICTED

RESTRICTED

deficiencies of the experimental furnace. Probably the combustion of the coal-tar products occurred during an insufficient intake of air, which led to a loss of germanium with the gaseous products of burning.

A. I. Yegorov and S. K. Kalinin carried out a study of germanium in the coals of Kazakhstan (Yegorov and Kalinin, 1940).

Five hundred samples from the following deposits were examined: 1. Karaganda, 2. Kenderlyk, 3. Sary-Adyr, 4. Dzhaman-Tuz, 5. Eki-Bastus, 6. Berchogur, 7. Lenger, 8. Kel'tematash, 9. Chukpak, 10. Khush-San, 11. Kara-Sai, 12. Taskanyr-Sai, 13. Vaykonur, 14. Tologoy, 15. Sagiz, 16. Kugalinskiy, 17. Usek, 18. Tangry-Bergen', 19. Voznesenskiy, 20. Bay-Khozha, 21. Peschanka, 22. Dzhehishke, 23. Shibayevskiy, 24. Rodnikovskiy, 25. Bos-Kupa, 26. Mamyt, 27. Ak-Su, 28. Kurasha-Say, 29. Lugovyy, 30. Anastasiyoka, 31. Chernyy zaton, 32. Kiyakty, 33. Kul'-Murza, 34. Bos-Irgen', 35. Bolat-Tam.

According to age, the numerous deposits are related to the Lower Carbon, Permian, Lower and Middle Jurassic, Upper Cretaceous and Tertiary Period.

Out of 35 deposits sampled, germanium was found only in eleven (Table 13).

Table 13

Content of Ge in Kazakhstan Coals (in %)

(according to Yegorov and Kalinin, 1940)

Deposit	Ash Content	Ge in Ash
Bay-Khozha, Kzyl-Ordynskiy Oblast	1.56	0.1-0.6
Saiz, Gur'yevskiy, Kzyl-Ordynskiy Oblast	5.00	0.1
Tangry-Bergen', Aktyubinskii Oblast	6.00	0.05-0.1
Peschanka, " "	6.60	0.05-0.1

(cont. next page)

RESTRICTED

deficiencies of the experimental furnace. Probably the combustion of the coal-tar products occurred during an insufficient intake of air, which led to a loss of germanium with the gaseous products of burning.

A. I. Yegorov and S. K. Kalinin carried out a study of germanium in the coals of Kazakhstan (Yegorov and Kalinin, 1940).

Five hundred samples from the following deposits were examined: 1. Karaganda, 2. Kenderlyk, 3. Sary-Adyr, 4. Dzhaman-Tuz, 5. Eldi-Bastuz, 6. Berchogur, 7. Lenger, 8. Kel'tomatash, 9. Chakpak, 10. Khush-San, 11. Kara-Sai, 12. Taskanyr-Sai, 13. Vaykonur, 14. Tologoy, 15. Sagiz, 16. Kugalinskiy, 17. Usek, 18. Tangry-Bergen', 19. Voznesenskiy, 20. Bay-Khozha, 21. Peschanka, 22. Dzhezhishke, 23. Shibaevskiy, 24. Rodnikovskiy, 25. Bes-Kupa, 26. Mamyt, 27. Ak-Su, 28. Kurasha-Say, 29. Lugovyy, 30. Anastasiyoka, 31. Chernyy zaton, 32. Kiyakty, 33. Kul'-Murza, 34. Boz-Irgen', 35. Bolat-Tam.

According to age, the numerous deposits are related to the Lower Carbon, Permian, Lower and Middle Jurassic, Upper Cretaceous and Tertiary Period.

Out of 35 deposits sampled, germanium was found only in eleven (Table 13).

Table 13

Content of Ge in Kazakhstan Coals (in %)
(according to Yegorov and Kalinin, 1940)

Deposit	Ash Content	Ge in Ash
Bay-Khozha, Kzyl-Ordynskiy Oblast	1.56	0.1-0.5
Saiz, Gur'yevskiy, Kzyl-Ordynskiy Oblast	5.00	0.1
Tangry-Bergen', Aktyubinskskiy Oblast	6.00	0.05-0.1
Peschanka, " "	6.60	0.05-0.1

(cont. next page)

27 RESTRICTED

Table 13 (cont.)

Deposit	Ash Content	Ge in Ash
Dzhanishke, Aktyubinskiiy Oblast	8.30	0.01-0.05
Chaklan, Yuzhno-Kazakstanskiy "	12.50	0.005
Kumnan, " "	12.50	0.005
Shibayevskiy, Aktyubinskiiy "	18.50	0.01-0.05
Ben-Kupa " "	17.00	0.01-0.05
Podnikkovskiy, " "	18.50	0.01-0.05
Anastasiyevskiy " "	18.50	0.005

On the basis of the experiments carried out, A. I. Yegorov and S. K. Kalinin calculated that in Paleozoic coals, among them varieties with low ash content, germanium is not concentrated. The Mesozoic coals of Kazakhstan are characterized by the greatest concentration.

Upon reviewing the data of A. I. Yegorov and S. K. Kalinin a doubt arises concerning the fact that out of 35 deposits the content of germanium over 0.005 percent was detected in only 11. Doubt about the correctness of these investigations grows still more during comparison of their data with the data of other investigators. Thus, for example, Yegorov and Kalinin did not discover germanium in the Mamyt coal deposits, at the same time that V. A. Zil'bermintz is showing that the content of germanium there is 0.1 - 1 percent, on the basis of the ash (Table 10).

These data exhaust the information on germanium in the coals of the Soviet Union.

RESTRICTED

III. METHODS FOR DETERMINING GERMANIUM

1. Survey of Methods Applied in Determining Germanium

In the laboratory of V. M. Goldschmidt, the determination of germanium was carried out by the method of spectrum analysis and X-ray spectrographic analysis.

Quantities of germanium of less than 0.01 percent were determined by the method of spectrum analysis, by means of a curved spectrum with the application of a concentration in the cathode layer (Mannkopf and Peters, 1931). The determination of the content of germanium was carried out by comparison of the intensity line of the germanium of the spectrogram examined with the intensity of the line of standard prints. For the preparation of standard prints mixtures of quartz and germanium oxide were used with five times as much germanium oxide. The sensitivity of the determination reached 0.0001 percent.

In a concentration of germanium of more than 0.01 percent the X-ray spectrographic method was used. Determinations were carried out by comparison of the intensity of the lines $K_{\alpha 1}$, $K_{\alpha 2}$, $K_{\beta 1}$ of the germanium with the corresponding lines of gallic oxide, which acted as a standard.

The method, adopted by V. M. Goldschmidt, is not completely successful from our viewpoint.

The advantage of spectrum analysis is the great sensitivity of the determination, which reaches 0.0001 percent. But such a high sensitivity, completely necessary in the determination of germanium in minerals and rocks in which germanium is not concentrated, is

RESTRICTED

RESTRICTED

unnecessary in an analysis of coals with a large percentage of germanium, as was the case in the investigations of V. M. Goldschmidt. Of much greater moment is the magnitude of the average probable error of determination, which is not indicated by V. M. Goldschmidt. In the determination of the percentage of germanium by means of visual comparison of the intensity of the line of germanium with the intensity of the line of standard prints, with five times as much germanium, the average probable error must have been more than 100 percent.

Also not entirely successful for the preparation of standard prints is the use of mixtures of quartz and germanium oxide, which differ significantly from ash of coals in chemical composition. The intensity of the line of germanium of the individual standards may differ significantly from the intensity of the line of the examined ash, containing the same quantity of germanium.

According to our observation, many coals together with germanium contain a significant quantity of gallic oxide. Therefore, the determination of germanium in the X-ray spectrographic method by comparing the intensity of the lines K_1 , K_2 , $K_{\beta 1}$ of germanium with the corresponding lines of gallic oxide, which serves as a standard, demands the introduction of the corresponding correction, to which V. M. Goldschmidt makes no reference. But even in that case, if the necessary corrections are introduced by us, the use of the X-ray spectrographic method for the determination of a high concentration, more than 0.01 percent, of germanium is linked with an incomparably higher error of determination than in a number of chemical methods.

RESTRICTED

RESTRICTED

W. Fuchs employed the methods of chemical and spectrum analysis. Their sensitivity and fineness are not given by the author. The non-correspondence of Fuchs' data with the data of other investigators, among them ourselves, indicates the imperfection of these methods.

G. Morgan and G. Davies determined germanium by the means of distillation of tetrachloride of germanium from a hydrochloric acid solution. The finely crushed ash was put in a still together with hydrochloric acid of the appropriate concentration. The presence of silicic acids, which prevented the completeness of the distillation of germanium, was disregarded, which accordingly lessened the values obtained for germanium, the details of which we dwell on a little further on. The data on the percentage of germanium in samples of the volatile portion of the ash, brought in by the authors, are diminished, giving an idea not about the actual content of germanium, but only about the quantity of metal which can be obtained during its industrial extraction.

T. Cook carried out the determination of germanium in the same fashion as G. Morgan and G. Davies by distilling germanium from hydrochloric acid solution. The ash which was being analyzed was placed in the distillation apparatus, where the germanium was distilled from the hydrochloric acid solution. The presence of silicic acid, which prevented the complete distillation of the germanium, was disregarded, which fact compels us to assume that the data adduced is significantly diminished.

In the laboratory of V. A. Zil'bermintz, germanium was determined by the method of spectrum analysis, by means of a curved spec-

RESTRICTED

trum. The concentration of germanium was established on the basis of the determination of the correlation of the blackening of the lines of germanium and platinum, which was utilized as an internal standard. For certain samples the presence of germanium was quantitatively verified by means of the distillation of germanium in the stream of chlorine and the further precipitation by hydrogen sulfide. The sensitivity of the determination was 0.01 percent.

The method used in the laboratory of V. A. Zil'bermintz is incomparably less accurate than the method of V. M. Goldschmidt. The sensitivity of the determination must be considered low; concentrations of less than 0.01 percent were not determined. On the other hand, concentrations of germanium of more than 1 percent, which are of special interest in studies of the products of benzol plants, could not be determined. In the analysis of the latter, the method which was being used led to an incorrect determination of the content of germanium; thus, according to V. A. Zil'bermintz, the content of germanium in the ash of coal-tar products and pitch must significantly exceed 1 percent (Table 7). But further examination established the percentage of germanium at 0.95, 0.89, 0.84 percent. It is extremely probable that the percentage of germanium in a number of other samples is also too high. Besides, the determination of the percentage of germanium on the basis of the correlation of the blackening of the line of germanium and platinum even for a comparatively narrow interval of 0.01 - 1 percent is unsuitable in consequence of the different nature of the agitation of the line of germanium and platinum.

V. M. Kostrikin determined germanium by the spectrum method, according to the method adopted in the laboratory of V. A. Zil'bermintz.

RESTRICTED

A. I. Yegorov and S. K. Kalinin determined germanium by the method of spectrum analysis (Borovik and Kalinin, 1939). For the quantitative determination standards with a content of germanium of 0.005, 0.02, 0.05, and 0.1 percent were prepared. The concentrations of germanium in the samples were determined according to the relative intensity of the lines of germanium in the samples being analyzed and in the standards, the spectrums of which were gathered on the same lamina. In addition, as an internal standard, platinum to the amount of 0.75 percent was injected, which afforded the possibility of passing over from the absolute intensity of the line to the relative. The sensitivity of the determination was 0.005 percent. The authors do not indicate the average error of the determination. We have already indicated the undesirability of using platinum as an internal standard in the description of methods, adopted in the laboratory of Zil'bermints, which differs little from the method of Yegorov and Kalinin.

2. Method of Chemical Determination of Germanium

The most reliable method of determining germanium, which was established classically, entails its distillation as a tetrachloride, which has a boiling point near 86 degrees, and the subsequent precipitation from a strongly acid disulfide solution. The determination is completed by the gravimetric method by means of the oxidation of the precipitated disulfide to dioxide (Buchanan, 1917; Dennis and Papish, 1923; Geilmann and Brunger, 1931, 1935; Lundin, 1933).

In the distillation of germanium chief attention is paid to the precipitation of arsenic, which often accompanies germanium and possesses chemical properties which are rather similar to those of germanium. Germanium, separated from other elements by distillation

RESTRICTED

in the form of tetrachloride and precipitated by hydrogen sulfide, may contain significant quantities of arsenic.

Among other methods of gravimetric determination of germanium should be noted the methods which are based on precipitation by tannic acid and cinchonine (Davies and Morgan, 1938), and also by orthohydroxyquinoline (Alimarin and Alekseyeva, 1939). At the same time, the precipitate obtained has a high molecular weight and accordingly is a contributing factor of the conversion to germanium.

Besides the gravimetric methods there were developed a large number of volumetric methods; for example, the titration of nitro-mannitol-germanic acid to alkali (Poluektov, 1936; Tchakirian, 1928).

For the determination of small amounts of germanium a number of colorimetric methods are proposed, among which should be indicated, in the first place, the method for obtaining yellow-colored germanic-molybdic acid (Alimarin and Ivanov-Emin, 1934); and, in the second place, the method for the recovery of this acid from molybdic blue by hydroquinone or sulfate of ferrous oxide (Poluektov, 1936).

Extremely small quantities of germanium can be determined also by means of the thermic separation of hydride of germanium in Marsh's tube (Coose, 1936).

All of the methods which have been indicated were worked out and applied chiefly in the analysis of minerals, which contain a high percent of germanium, or in analysis of zinc blende and commercial zinc oxide. The determination of germanium in the ashes of mineral coals, described by Alimarin and others (1940) does not differ in nature from the classical methods of determining germanium by the

34
RESTRICTED

RESTRICTED

gravimetric method. For ashes of coals with a low, less than 0.05 percent, content of germanium the multiple precipitation of germanium orthohydroxyquinoline is recommended (Alimarin and Alekseyev, 1939).

Proceeding to the determination of germanium in coals, we have in mind the micromethod, which is suitable for the determination of extremely small, up to 0.0001 gram, quantities of germanium, which was necessary from our point of view for the verification of the determination by the method of spectrum analysis. At the same time, the micromethod which was used must have been sufficiently reliable.

The Ashing of Coal

In the ashing of coal for the analysis it is feared that a loss of germanium in the form of easily volatile oxide and germanic sulfide may take place as a result of insufficient admission of oxygen.

In order to avoid the loss of germanium, V. M. Goldschmidt recommends the carrying out of ashing in porcelain dishes over the flames of a gas burner with moistening by nitric acid (Goldschmidt, 1937).

V. A. Zil'bermintz and his collaborators consider it more expedient to carry out the ashing in muffle furnaces with a preliminary cooking (Zil'bermintz, Rusanov and Kostrikin, 1936).

A. I. Yegorov and S. K. Kalinin used calcination of crushed coals in the muffle furnace before complete ashing.

For an explanation of the possible loss of germanium during the preparation of the material for analysis, we carried out the ashing of various portions of coal over the flames of a gas burner and

RESTRICTED

RESTRICTED

in the muffle furnace with a different quantity of oxygen admitted. A large quantity of similar material was crushed, from which portions were taken, following the rules for taking average samples. Ashing was carried out in porcelain dishes of the same size.

The results are shown in Table 14.

Table 14.

Method of Ashing Coals

Method of Ashing	Portion, g	Time of Ashing		Content of Ge, %
		Hours	Minutes	
Over flame of gas burner.....	5	6	00	0.030
The same.....	15	6	00	0.032
The same with moistening by nitric acid.....	5	3	00	0.028
The same.....	15	3	00	0.029
In muffle furnace without a sup- plementary supply of air...	5	4	00	0.031
The same.....	15	4	00	0.032
In muffle furnace with supple- mentary supply of air by pump	---	--	--	-----
Supply of air per minute -- 1.09 liters.....	5	2	32	0.030
The same.....	15	2	32	0.033
In muffle furnace with supple- mentary supply of air by pump --	--	--	---	-----
Supply of air per minute -- 7.5 liters.....	5	1	46	0.032
" " " " "				
" "	15	1	46	0.029

RESTRICTED

As shown in the experiments carried out, the ashing over flames of a gas burner and in a muffle furnace give identical results. Moistening with nitric acid in the process of ashing, which saves time, has no other advantages. Supplementary supply of air in the muffle furnace can be recommended only for the purpose of accelerating combustion. Portions of coal in the range up to 15 grams does not lead to noticeable increase in the loss of germanium in comparison with the portion of 5 grams.

On the basis of the experiments carried out, the following order of preparing coal for analysis was adopted. Crushed coal in quantities of not more than 15 grams were reduced to ashes in fine layers in porcelain dishes over the flames of a gas burner or in a muffle furnace at a temperature not higher than dark red at the bottom of the bowl (500-600 degrees).

The Fusion of Ash

Compounds, in the form of which germanium is found in mineral coals, are unknown to us. During ashing of coal, the germanium enters into combination with silicon and, apparently, is present in the form of complexes that are analogous to alumo-silicates, as was indicated in his time by T. Cooke, during the study of the coals of Australia (Cooke, 1938). Further, A. K. Rusanov, studying the ash of coals in the flame of a voltaic arc, verified the bond of germanium with the silicate portion of the ash, drawing from that, incompletely, the basic conclusions regarding the origin of germanium in coals in the form of germanates (Rusanov and Alekseyeva, 1941).

For verification of the possibility of carrying out the determination of germanium in the presence of silicic acid without decom-

RESTRICTED

RESTRICTED

position of the material, as was carried out by G. Morgan and G. Davies (1937 and T. Cooke (1938), we carried out an experiment on the distillation of germanium directly from the ash.

Given ash 1. The content of GeO_20.0030 g.
 GeO_2 found.....0.0015 g.
 GeO_2 lost.....0.0015 g.

For the verification of the possibility of carrying out a determination of germanium with a decomposition of material, but in the presence of silicic acid, a suitable experiment was conducted. A portion of GeO_2 was fused with 1 gram SiO_2 and 8 grams Na_2O_2 . The alloy was dissolved in water and the germanium was distilled from the acid solution in the presence of the silicic acid.

Given GeO_20.0082 g.
 GeO_2 found.....0.0090 g.
 GeO_2 lost.....0.0022 g. = 27%

The experiments carried out by us showed that the ashes of coals without decomposition are exactly the same as in the presence of decomposition, but in the presence of silicic acid could not be analyzed.

A still greater loss of germanium during distillation in the presence of silicic acid is indicated by Lundin; according to Lundin only 10 percent of the germanium is distilled, the rest of the quantity remaining in the residue (Lundin, 1933).

The decomposition of the ash of coals can be attained either by processing hydrofluoric acid or by fusion with sodium peroxide. The first method, recommended by I. Alimarin and B. Ivanov-Emin (1940) for ashes that do not contain chloride, is more rapid, so that

38
 RESTRICTED

RESTRICTED

the distillation of germanium can be carried out at once after the decomposition of the sample. However, this method is unsuitable for the decomposition of the ashes containing chloride, which are always encountered in the ashes of mineral coals.

A considerably more reliable method of decomposition is by fusion with sodium peroxide, during which a loss of germanium does not occur, neither during the decomposition of the material, nor during the further precipitation of germanium by hydrogen sulfide. In addition, during the fusion the oxidation of the residues of the coal and the organic compounds took place. In our work, we utilized only the method of fusion with sodium peroxide.

Decomposition by the method of fusion was linked with the necessity of a preliminary precipitation of the sulfides before distillation.

Distillation

For the separation of germanium from other sulfides, which precipitate together with it in the process of a preliminary precipitation of hydrogen sulfide, distillation in a stream of chlorine is usually used. Considering the possibility of a loss, besides, of germanium from the container in the form of tetrachloride, bromine and perhydrol were used as oxidizers. The experiments that were conducted showed the quantitative precipitation of germanium -- see Table 15.

Table 15

Experiments on the Distillation of Ge in the presence of the Oxidizing Agent Bromine (Wgt. in grams)

Content of Ge in the ash	Ge Found	Error
0.0010	0.0010	0.0000
0.0010	0.0011	0.0001
0.0225	0.0219	0.0006

RESTRICTED

Of great importance during distillation of germanium is the general quantity of distillate, which it is necessary to distill for complete separation of germanium, and also the possibility of losing germanium from the container, which requires complicating the apparatus by setting up control flasks in order to recover the germanium.

The experiments carried out show that during the slow process of distillation the entire quantity of germanium is recovered in the container, and thus the setting-up of control flasks is not required. Exactly as in refrigeration there is no necessity for a container with ice. The quantity of distillate in the container must consist of 200-250 cubic centimeters.

Precipitation of Germanium Sulfide

During the precipitation of germanium by hydrogen sulfide the basic conditions are, on the one hand, a suitable acid solution, and on the other, complete saturation of the hydrogen sulfide.

In case a precipitate of germanium sulfide does not form during the passage of hydrogen sulfide, it is recommended that a few drops of sodium hyposulphite or mercuric chloride be added; the germanium sulfide is then absorbed on the sulfur or mercury sulfide crystals.

In a small quantity of germanium better results are obtained, according to I. P. Alimarin (Alimarin and Ivanov-Emin, 1936), if ammonium sulfide is added to the weak ammonium solution at the beginning, and then the necessary quantity of hydrochloric acid.

Using a concentration of acid of 4 - 6 N in the solution and treating the solution with a stream of hydrogen sulfide for one hour

RESTRICTED

RESTRICTED

in the cold, we obtained in all cases a precipitate of germanium sulfide without the introduction of any other precipitant, which was verified by appropriate experiments.

The experiments carried out showed a complete separating out of germanium sulfide from the extremely dilute solutions. An error of 0.00005 grams in the determination of complete precipitation was due to the precision of weighing on the analytical balance.

The completeness of precipitation in relatively high germanium content, in several ten milligrams, was reached usually by single-stage precipitation with hydrogen sulfide. The quantity of germanium, which was precipitated by repeated passage of hydrogen sulfide, did not go beyond the limits of error of weighing.

In the washing of the filter containing the precipitate of germanium sulfide, using sulfuric acid saturated with hydrogen sulfide, 5 N sulfuric acid was used, since according to Dennis and Papish (1923) this was more suitable than 3 N.

Gravimetric Determination of Germanium

The determination of germanium was carried out by means of the gravimetric method -- by calcination of the precipitate to dioxide. The method developed by Dennis and Jones -- distillation of germanium sulfide in a filter with ammonia with the subsequent oxidation of the thiogermanium with perhydrol -- was not applied. As the experimental data of Alimarin and others (1940) showed, the direct calcination of germanium sulfide in a weighed porcelain crucible is sufficiently reliable and quicker. For a more rapid combustion of the filter and to avoid loss of germanium in the form of oxide, the filter is periodically moistened with nitric acid. Following com-

//
RESTRICTED

RESTRICTED

plete calcination the precipitate is burned in a muffle furnace.

As shown by the experiments of I. P. Alimarin and others (1940) small quantities of arsenic, which are present in the sulfide precipitate, are volatilized during complete burning and do not affect the accuracy of the results.

The experiments conducted by us showed that by means of the gravimetric method extremely small quantities of germanium can be determined. An error of ± 0.00005 grams in the determination of small amounts of germanium was due to the precision of weighing on the analytical balance.

The determination of small quantities of germanium in the form of complex ions which possess great molecular weight and, consequently, favorable factors of conversion as, for example, tannin or cinchonine (Davies and Morgan, 1938), was rejected by us. Such precipitates of organic compounds usually absorb different quantities of other elements, which leads to an error in the determination of germanium.

We carried out a check of the method of determining germanium with the aid of O-hydroxyquinoline for the ashes of coals (Alimarin and Alekseyeva, 1939). The accuracy of the results of the determination of germanium both by this method and also by all others based on the utilization of the properties of germanomolybdenum oxide depend chiefly on the amount of correction of the experiment, in consequence of the contamination of reactions with admixtures of silicic oxide, which is difficult to avoid in work with alkaline solutions.

The results of the check are shown in Table 16 (see samples No. 11, 32, 128, 199).

112

RESTRICTED

RESTRICTED

The check carried out verified the possibility of using o-hydroxyquinoline for the determination of extremely small quantities of germanium, and a part of the determination was carried by this method. But from our point of view, the broad use of the method of precipitating germanium with o-hydroxyquinoline is unsuitable. This method specifies the carrying out of an additional operation -- the precipitation of germanium in the form of oxyquinoline-germanomolybdate $[\text{C}_9\text{H}_7\text{ON}]_4 \cdot \text{H}_4 [\text{Ge}(\text{Mo}_{12}\text{O}_{40})_7]$, which is combined with the use of freshly prepared reagents, and therefore considerably complicate and prolong the course of the analysis. Sufficiently reliable results are obtained during the determination of relatively large quantities of germanium, which can be weighed on the analytical balance in the form of dioxide.

Spectrum analysis is more reliable and quicker for material with less germanium content.

The determination of germanium in the ashes of coals, which was carried out by chemical means, is shown in Table 16.

Course of the Analysis

Separation of the Material

A portion of ash of 1 - 3 grams is fused in an iron crucible with an eight-fold equivalent of sodium peroxide. The fusion mixture, after cooling the crucible, is extracted with 200-600 millimeters of water, with such a calculation so that after acidification a loss of silica gel did not occur. The cool solution of the fusion is neutralized with dilute (1:1) sulfuric acid. Then a surplus of sulfuric acid is added in such a quantity that the acidity of the solution was equal to 5 - 6N.

43

RESTRICTED

RESTRICTED

For the preliminary concentration of germanium the cold acid solution is transferred to the Erlenmeyer flask and for one hour is saturated with hydrogen sulfide, after which the flask is sealed with a rubber stopper. After 24 hours in the flask, the hydrogen sulfide is again filtered for 20 - 30 minutes, the precipitate is allowed to stand, then is filtered off through a dense filter and washed with 5 - 6N sulfuric acid, saturated with hydrogen sulfide.

The precipitate, which contains germanium sulfide, sulfur, and also sulfides of other metals, which are precipitated together with germanium, are washed with a small quantity of water in the flask in which the precipitation takes place. The filter is washed with 20-30 millimeters of a hot 10 percent sodium hydroxide solution. The alkaline solution is heated to boiling, 10 - 15 drops of perhydrol is added for the oxidation of the sulfides, after which the solution is heated for ten minutes. At the same time all of the germanium goes into solution.

Table 16

(see following page)

- 44 - RESTRICTED

RESTRICTED

No. of Sample	Method of Determination of Germanium	Table 16						
		Weight of Ash	Weight of Filter or Crucible	Weight of Filter or Crucible with Precipitate	Correction for Experiment	Weight of the Precipitate Hydroxyquinoline-germanomolybdate	Weight of Precipitate Germanium Dioxide	Content of Germanium Dioxide in % in the Ash
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
2	In the form of							
	hydroxyquinoline-	2.000	11.3410	11.3481	0.0012	0.0059	0.00028	0.01
	germanomolybdate	1.000	15.9404	15.9437	0.0011	0.0022	0.000098	0.01
11	In the form of	1.000	3.9858	3.9867	---	---	0.0009	0.09
	dioxide	1.000	5.7153	5.7161	---	---	0.0008	0.08
	In the form of							
	hydroxyquinoline-							
	germanomolybdate	1.000	13.8075	13.8241	0.0014	0.0182	0.00067	0.07
32	In the form of	3.000	5.2216	5.2225	---	---	0.0012	0.04
	dioxide	3.000	14.9379	14.9386	---	---	0.0007	0.02
	In the form of							
	hydroxyquinoline-							
	germanomolybdate	1.000	11.3445	11.3526	0.0027	0.0054	0.00024	0.02
55	In the form of							
	dioxide	1.000	4.7716	4.7745	---	---	0.0029	0.29
67	In the form of							
	hydroxyquinoline-	1.000	15.9422	15.9472	0.0022	0.0028	0.00013	0.01
	germanomolybdate	2.000	13.8080	13.8167	0.0030	0.0057	0.00028	0.01
128 128	In the form of							
	dioxide	2.000	4.3425	4.3426	---	---	0.0001	0.005
	In the form of							
	hydroxyquinoline-	1.000	11.3429	11.3474	0.0030	0.0015	0.00007	0.007
	germanomolybdate	2.000	15.9429	15.9483	0.0030	0.0024	0.00011	0.005

(cont. next page)

RESTRICTED

RESTRICTED

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
109 In the form of	1.000	10.5029	10.5031	---	---	0.0002	0.02
dioxide	1.000	15.9110	15.9114	---	---	0.0004	0.04
	1.000	5.2210	5.2214	---	---	0.0004	0.04
In the form of							
hydroxyquinoline-	1.000	12.9960	12.9964	0.0027	0.0037	0.0003	0.03
germanomolybdate	1.000	15.9459	15.9450	0.0027	0.0044	0.00029	0.03

RESTRICTED

Distillation

For the distillation of germanium an apparatus was used which is usually required in laboratories for distillation of arsenic. It consists of a flask of 300 milliliter capacity. In the upper part of the neck a stopper with a dividing funnel, which supplied the stopcock, was inserted. The supplementary tube of the flask is connected with the condenser. The pipe of the condenser is connected with ^areceiving flask, in the bottom of which is poured hydrochloric acid of specific gravity 1.095.

The alkaline solution of sulfide is transferred to the distillation flask, connected through the condenser with the receiving flask. Into the flask is poured about 20 milliliters of hydrochloric acid with a specific gravity of 1.095, so that the pipe of the condenser was immersed in it. Through the funnel with the stopcock in the distillation flask is poured hydrochloric acid (specific gravity 1.19) in a quantity approximately equal to the volume of the alkaline solution. The optimal concentration of hydrogen chloride must amount to 200 - 210 grams per liter. In weaker concentrations of hydrogen chloride the tetrachloride of germanium is not completely distilled, whereas in greater concentrations an incomplete condensation of it occurs.

Then through the funnel is poured 3 - 4 milliliters of distilled bromine for the oxidation of the sulfide compound and arsenic, after which the distillation of the tetrachloride of germanium is started. The distillation flask is heated in the beginning over a low flame, and then over a higher flame, regulating the temperature so that the liquid is boiled uniformly without bumping.

RESTRICTED

RESTRICTED

During the distillation process the free bromine already for several minutes partially passes into the container, partially is combined with the iron, which may lead to distillation of trichloride of arsenic together with tetrachloride of germanium. For complete oxidation of arsenic in the distillation flask from the funnel with the stopcock, perhydrol is added drop by drop, which leads to the formation of free bromine. The addition of perhydrol drop by drop permits the carrying out of the entire process of distillation in the bromine stream, not adding the latter.

After distillation of half the volume of the liquid, the heating is discontinued, the flask is cooled a little, after which is introduced 100 milliliters of hydrochloric acid with a content of 200 - 210 grams of HCl in one liter, and then the distillation is continued. Upon completion of distillation the general volume of the distillate reaches 200 - 250 milliliters.

Precipitation of Germanium Sulfide

To the distillate from the bromine reaction is added a concentrated solution of hydroxylamine hydrochloride prior to discoloration, and the acidity of the solution is determined. If the concentration of the acid proves to be below 4 - 6N, then the necessary amount of sulfuric acid is added; if above, then the solution is diluted with water accordingly.

The cooled solution is saturated for an hour first of all with purified hydrogen sulfide. The solution which is saturated with hydrogen sulfide is left overnight in the flask, sealed with a rubber stopper. The following day the precipitate is filtered through a dense ash-free filter. The washing is carried out with 5 - 6N sulfuric acid, saturated with hydrogen sulfide, until the precipitate is free from chloride ion.

RESTRICTED

Determination of Germanium

The precipitated disulfide of germanium is determined by the gravimetric method in the form of dioxide. For this purpose the washed precipitate, together with the filter, is placed in a weighed porcelain crucible and carefully carbonized by heating on an asbestos grating. Then the crucible is cooled, the precipitate is moistened with concentrated nitric acid and the surplus acid is removed by heating, after which the crucible is transferred to the triangle and calcinated at low temperature prior to calcinating the remnants of the filter. The calcinated precipitate is again moistened with nitric acid and calcinated in the muffle furnace until complete discoloration is effected.

3. Method of Spectrum Determination of Germanium

During the determination of germanium by the spectrum analysis method, as a source of excitation of the spectrum there was used the flame of a voltaic arc between the angles of electrodes with a diameter of 6 millimeters, mounted vertically. The angular electrodes first of all were purified by heating in air at a temperature of 3000 degrees (Rusanov and Kostrikin, 1940). The heated carbons contained only a line of boron;

2496.8_A; 2497.7_A

From among a large quantity of possible methods for introducing the material being studied into the flame of the arc, the method was adopted, which makes use of low convection, of placing the material in the aperture of the angular electrode.

Large portions of analyzed material had to be refused as not permitting the obtaining of accurate quantitative data. Thus, even

RESTRICTED

RESTRICTED

the method of A. K. Rusanov, based on the gradual introduction of a portion of material into the flame of the arc on a strip of paper (Rusanov and Bodunkov, 1940; Rusanov, Bodunkov and Movchan, 1941), which possesses definite advantages over the different methods of dusting (Kuz'mina, 1937, 1938; Nedler, 1936; Safonov, 1940), does not allow complete burning, and therefore is less reliable than methods which are based on total burning of the material. A portion of the ash being studied in a quantity of 0.015 grams is weighed on the analytical balance and placed in the recess of the lower negative electrode, bored with the aid of a drill. The recess was 2.0 millimeters in diameter and 6.0 millimeters in depth. The size of the recess was strictly controlled.

The voltaic arc was fed direct current with a force of 8 amperes at 110 volts. The light from the voltaic arc was projected onto the aperture of a Zeiss quartz spectrograph with the aid of a quartz lens. The voltaic arc was projected onto a screen, the distance between the terminals of the electrodes during the burning of the arc being kept constant. Through an opening in the screen, the light from the flame of the voltaic arc was directed previously by means of the quartz lens onto the aperture of the spectrograph. The photographing of the spectrum was carried out on plates of the NIKFI with a sensitivity of 200 - 600 in KhD.

The plates were developed for dash prints with a developer of the following composition:

Water, ml.	440
Sodium Acid Sulfate, g.	30
Hydroquinone, g.	6
Potassium Bromide, g.	2
Potassium Hydroxide, g.	2

RESTRICTED

RESTRICTED

The specified developer was used to obtain clear, non-fogged spectrograms.

The presence of germanium was determined on the basis of the appearance in the spectrograms of the strongest conclusive lines of the germanium spectrum:

2651.60 A; 2651.15 A; 3039.08 A

The content of germanium was determined chiefly according to the method of the internal standard. In the selection of an internal standard the nature of the excitation in the voltaic arc of the spectrum lines of a whole series of elements was studied. For this purpose, the elements in question were added to the ash of the coal containing germanium and the material was spectrographically analyzed. As internal standards were analyzed: platinum, palladium, rhodium, antimony, cadmium and bismuth. The photographing of the spectrum was carried out on a plate during the constant movement of the adapter. Depending on the duration and intensity of vaporization of the elements in the flame of the arc, spectrum lines of different length and intensity were obtained on the moving plate during the photographing. Measuring the length of the lines offered the possibility of calculating and comparing the duration of vaporization of the separate elements.

The line of bismuth, which was adopted as an internal standard, appeared to be the most homologous and the nearest in the nature of its excitation in relation to germanium.

During the examination of the spectrograph of the ash of the coals from the deposits being studied, bismuth was not detected in it.

The possibility of using platinum, as has been repeatedly pointed out (Yegorov and Kalinin, 1940; Zil'bermints, Rusanov and

RESTRICTED

Kostrikin, 1936; Rusanov and Kostrikin, 1936), was rejected. The nature of the excitation of the platinum line, as well as other metals of the platinum group, differs considerably from the line of germanium.

A quantity of bismuth, when introducing it in the capacity of an internal standard, was determined by means of suitable experiments. Ash of the coal with a germanium content of 0.01 percent was taken for the experiments. In comparing the lines of germanium and bismuth that were favorable for photometry, it was found:

Germanium 3039.08 Å; Bismuth 3024.65 Å

In a concentration of bismuth equalling 0.01 percent, a line of bismuth is not visible

" " " " " 0.03 percent, a

" " " is weakly visible

" " " " " 0.1 percent, a

" " " is weaker than the line of germanium

" " " " " 0.3 percent, the

intensity of the line of bismuth and germanium are

approximately the same.

On the basis of the experiments carried out, we recognized that a concentration of bismuth of 0.2 percent was more suitable.

By measuring the length of the lines of germanium and bismuth of different content in the ashes of the coals, the time necessary for their complete burning out and suitable exposure was determined. In a sample of material of 15 mg (sic) the exposure was taken in 90 seconds.

RESTRICTED

As standards were taken the natural ashes of coals, the germanium content of which was especially carefully determined (with several parallels) by chemical methods. In those cases in which, from among the natural ashes, the desired concentration of germanium was not obtained, the latter was added to the natural ashes in the form of spectral-pure germanium dioxide, with a subsequent verification of the prepared standard.

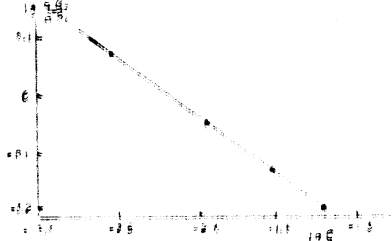


Fig. 1. Curve for the determination of germanium in a concentration 0.003--0.060% according to the internal standard.

The scale of the standards was matched with the threefold variation in the content of germanium. Bismuth in a quantity of 0.2 percent in metal that was guaranteed against appreciable error in the possible appearance of traces of bismuth in the ashes of the coals, was introduced as a standard, and also in the material being analyzed in the form of an aqueous solution of bismuth nitrate. The uniform diffusion of the introduced bismuth was achieved by the pulverization in an agate mortar of ashes dried in the thermostat. It should be observed that the pulverization of 0.5 grams of ash required nearly 1 hour. The uniform diffusion of bismuth was not achieved with a pulverization of less duration.

The concentration of germanium in the ashes was determined on the basis of measuring the relationship of the intensity of the following lines, which are suitable for photometry:

germanium 3039.08 Å; bismuth 3024.65 Å.

RESTRICTED

The photometry of the spectrum lines was carried out by means of a Zeiss microphotometer.

The dependence of the relative intensity of the lines on the percent of germanium content in the ash is expressed by means of curves. On the axes of the abscissas the concentrations of germanium are plotted logarithmically; on the axes of the ordinates are the logarithms of the rate of deviation of the galvanometer $\frac{d\phi}{dI}$ for the photometric lines.

For each sample of ash analyzed, and also for each standard used, a triple photographing of the spectrums was carried out.

Each spectrogram was measured three times with the photometer.

To draw up the curve, the average of the measurement of the three spectrograms was taken.

A general view of the curves for the determination of different concentrations of germanium according to an internal standard is represented in figures 1 and 2. To calculate the average probable error in the determination of the content of germanium according to an internal standard, a tenfold plotting of the material being analyzed was performed. The results of the measurement of the spectrograms by means of microphotometry are brought out in Table 17.

The average probable error of determination according to the external standard equals 8.0 percent.

Simultaneously with the determination of germanium by the method of the external standard, control determinations were carried out by means of a comparison of the intensity of the lines of germanium with the intensity of the background. The background was measured with a photometer in direct proximity to the line 3039.08 Å. The content of germanium was determined on a curve, plotted according to the method described above.

RESTRICTED

Table 17

Calculation of the Average Probable Error of Determination of
Ge according to the Internal
Standard

Reading of the Microphotometer		Ge/B1	Deviation from the Average Rate	Reading of the Microphotometer		Ge/B1	Deviation from the Average Rate
Ge	B1			Ge	B1		
70	23	3.0435	- 0.1839	132	46	2.8333	- 0.2841
104	32	3.2500	+ 0.0226	92	30	3.0666	- 0.1605
66	20	3.3000	+ 0.0726	68	20	3.4000	+ 0.1726
73	18	4.0555	+ 0.8281	103	30	3.4333	+ 0.2059
71	24	2.9583	- 0.2691	119	42	2.8333	- 0.2841
Average.....						3.2274	± 0.2604

Table 18

Calculation of the Average Probable Error of Determination of
Ge on the Background

Reading of the Microphotometer		Rate Ge	Deviation from the Average Rate	Reading of the Microphotometer		Rate Ge Background	Deviation from Average Rate
Ge	Background			Ge	Background		
77	266	0.2939	- 0.0260	106	298	0.3557	+ 0.0356
90	288	0.3125	- 0.0074	99	264	0.3750	+ 0.0551
60	261	0.2644	- 0.0555	77	268	0.2873	- 0.0326
108	297	0.3636	+ 0.0437	81	264	0.3068	- 0.0131
Average.....						0.3199	± 0.0336

RESTRICTED

RESTRICTED

A general view of the curves for the determination of germanium in various concentrations on the background ¹⁶ are represented in figures 3 and 4.

For the determination of the average probable error in the determination of the content of germanium on the background an eight-fold plotting of the material being analyzed was performed. The results of the measurement of the spectrogram by means of a microphotometer are brought out in Table 18.

The average probable error of determination on the background equals ± 10.6 percent.

The experiments carried out verified the possibility of using for the determination of any concentration, instead of the internal standard, the background, which although somewhat increasing the probable error of the determination, affords a considerable saving of time.

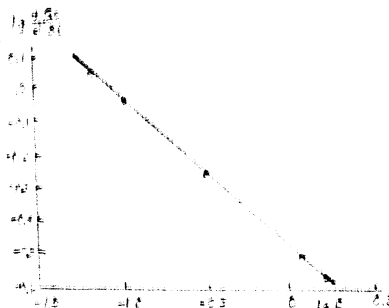


Figure 2. Curve for the determination of germanium in a concentration of 0.060 - 1.300 percent according to the internal standard.

The use of the method of the background, proposed by S. A. Borovik (1942), is especially expedient for the determination of small concentrations, in which the average probable error is reduced in comparison with the method of the internal standard.

RESTRICTED

As shown by the works of N. S. Sventitskiy (1939, 1941), good analytical results can be obtained by the use of the voltaic arc with an activator delivering alternating current. The activated arc of alternating current, possessing high stability of excitation of the spectrum, is used to obtain a corresponding high stability of analytical results. Not submitting evidence on the accuracy of the results on the condensed spark, according to S. L. Mandel'shtam (1941), the activated arc surpasses the spark in sensitivity of analysis.

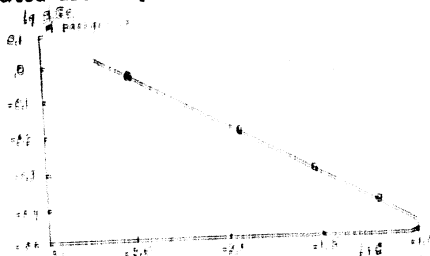


Figure 3. Curve for the determination of germanium in a concentration of 0.003 - 0.060 percent on the background.

A disadvantage of the activated arc is the darker background of the spectrogram obtained. As shown by S. A. Borovik (1945), better results are obtained by using the activator only for igniting the arc.

Part of the analytical data was obtained by us with the aid of an arc using alternating current of 220 volts and ignited with the aid of an activator.

IV. RESULTS OF THE ANALYSIS AND CONSIDERATION OF THEM

1. Description of the Analyzed Material

Entering upon a study of germanium in coals, we centered our attention on the large deposits of the Urals, Caucasus, and Kuzbas, which possess industrial importance, as objects for the study.

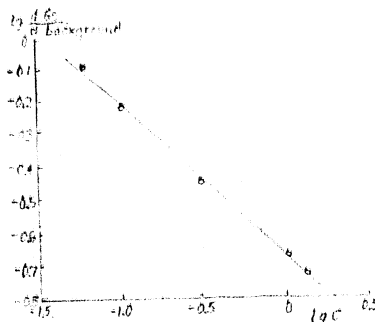


Figure 4. Curve for the determination of germanium in a concentration of 0.060 - 1.300 percent on the background.

RESTRICTED

RESTRICTED

Deposits of the Caucasus. Khumarin coal deposit. Lower Jurassic (Liassic); laminated, lustrous coals.

Deposits of the Urals. Chelyabinsk brown coal basin. Upper Triassic (Rhaetian), Lower Jurassic (Liassic); laminated coals; Korkin and Kopey deposits.

Yegorshin coal basin: Carbon; Anthracite, often graphitized; Yegorshin deposit.

Deposits of the Kuznets Basin. The Lenin and Kiselev deposits, chiefly: Upper Carbon, Lower Permian; laminated coals.

In sampling the Ural and Caucasus basins, we collected, directly at the deposit, over 500 samples of coal and rock. Samples of siftings were also collected, obtained during the processing of coals of the Urals, and also the ashes from the Kashir and Stalinogor GRES, which operate on coals from the Podmoscow Basin.

Besides the material collected directly at the deposit, average samples from a number of seams of the Kuzbas were studied, and also museum samples of a number of deposits.

2. Description of the Khumarin Deposit

Already the first determinations of germanium in the collected material have shown extremely strong variations, both among the separate coal deposits and also in their extent. A considerable concentration takes place in the coals of the Khumarin deposit (Caucasus), where the content of germanium in the separate samples reaches 1 percent in the ash. The coals of the Urals are distinguished by a lower content of germanium; it is especially low in the coals of the Yegorshin deposit, not exceeding 0.001 percent in the ash. The coals of the

RESTRICTED

Kuznets Basin occupy an intermediate position in regard to germanium content.

The geological setting and the nature of the coals of the Khumarin deposit appeared to us to be more favorable for the purpose of approaching the problem concerning the accumulation of germanium in them.

The Khumarin coal deposit is located in the Mikoyanov Rayon of the Karachayev Autonomous Oblast. It is situated on both banks of the Kuban River. The southern boundary passes through the Mikoyan-Shakhar; the eastern extends from it 15 kilometers below along the Kuban River. On the Kuban side the deposits extend for 6 kilometers to the east and 3 kilometers to the west.

Orographically, the deposit corresponds to the valley of the Kuban River and the system of its deep, lateral ravines, the watersheds between which are relatively high -- up to 200 - 250 meters. The absolute geodetic altitude of the Kuban River is 780 meters; the maximal geodetic altitude of the individual crest is 1500 meters. The slopes of the ravines are extremely steep and often accompanied by sheer cliffs with folded massive sandstones.

On the geological side the deposit is part of a considerable area of Jurassic carboniferous sedimentation of the Northern Caucasus. The Lower Liassic age of these sedimentations is established for the Khumarin deposit both according to flora (Koshkul', 1867; Krishtofovich, 1927) and also according to the overlapping carboniferous sedimentations horizon, which contain "aalen" fauna (Agalin, 1929). The thickness of the carboniferous stratum is nearly 600 meters. Basically, the carboniferous stratum of Khumar is represented

RESTRICTED

by gray and light-gray, medium and fine-grained sandstones of average toughness. Part of the sandstones occur in the form of massive, unstratified layers of up to 35 meters thickness, which are exposed for a great distance. The second group of sandstones occur in the form of thinly laminated layers, which are not exposed in length or thickness, alternating with similar layers of sandy and clayey slate. This gray sedimentation contains layers and seams of coal.

The lower part of the carboniferous stratum is broken by igneous rocks, represented by diabases, porphyrites and keratophyres, which occur in the form of deposits, inter-strata intrusions and dikes. These rocks are accompanied also by their tuff and tufaceous materials. Direct contact of the intrusion takes place with the carboniferous strata. At a number of points, aqueous solutions, combined with extrusive rocks, are ore-bearing. The poly-metallic deposits of the El'brus mine and its vicinity are found on the bank of the Kuban River above the Khumarin deposit, connected with the intrusion, as yet not exposed by erosion. According to F. I. Vol'fson and A. A. Medvedyuk (1939), hydrothermal solutions, which form deposits, circulating in tectonic dislocations, must rise up from great depth. In passing through a thick strata of rocks, these solutions must have lost a number of elements, in particular, silver.

The region of the deposits is situated in the central part of the tectonic zone of the northern slope of the Caucasus range, in which the mountain-forming movement was completed at the beginning of the Jurassic Period. The subsequent orogenic movement in it was reflected chiefly by the appearance of a large amount of dislocation, principally of fault amplitudes of 5 to 150 meters, which break up the entire deposit into a number of blocks.

RESTRICTED

7
RESTRICTED

The coefficient of the coal content of the deposit, according to S. I. Levitskom (1940), equals 0.6. Strata of low-quality coal predominate. In the lower range of thickness, in which operation is profitable, it is fixed at 0.45 meters. Out of an aggregate number of 51 seams only three are operating.

The petrographic characteristic of coals, developed by A. V. Sadkova (1935), shows that coal of all seams is rather similar and composed of two ingredients: clarain and vitrain. Fusain, independently, is not important and occurs as small seams in clarain. One sample, in which it is found in negligible quantity, is an exception. Coal may refer to the clarain type with a large content of vitrain.

With the original plant material, as shown by a study of the microstructure of the coal, were the pedicle parts of plants. The leaves, microspore and resin played a subordinate role. The pedicle parts were subjected to an intense process of chilling, as a result of which part of them passed over into structural vitrain. But further chilling of tissue in combination with the activity of microorganisms led to partial or complete disappearance of the cellular structure and to the formation of non-structural vitrain and a transparent humic mass.

The cuticula, judging by the closed bands in the vertical section, belonged to the leaves. The sheaths of microspores and pollen in the coals are well-preserved. They are encountered with great frequency widely diffused, but sometimes they are observed also in conglomerations.

Resinous bodies play a conspicuous role in the formation of coal, which is reflected also on the exterior of its form, giving it

RESTRICTED

a more intense luster. The resinous bodies, having a different size and form, are observed in the structure of vitrain, clarain and the remains of leaves. In structural vitrain, resin fills the cavities of the cells, and therefore is found in situ. Such a content of resins shows that the plants which form coal were rich in resin and belonged, probably, to the conifers.

The data brought out permits us to refer the coal of all the which were analyzed to the humic coals of a low degree of coalification. Their humic nature is determined by means of plant raw material from which the coals are formed. The low degree of coalification appears in the resinous luster of the coal, in the color pattern -- from brown to black, high transparency of thin sections, the highly preserved cellular structure of the pedicle tissue of the plants, the yellow color of the cutinized regular elements and the resins, and finally, in the reddish-brown color of the basic humic mass and vitrain.

The petrographic similarity of coals is verified by the data of an elementary analysis.

3. New Analytical Data on Germanium in Coals

The determinations of germanium in the coals of the Khumarin deposit are shown in Table 19.

Besides the coals of the Khumarin deposit, samples of coals from the Chelyabinsk and Yegorshin fields, collected directly at the deposits, were analyzed for germanium, and also specimens and samples of coals from various deposits, obtained from museums and institutions. Among the latter should be noted the average samples of a number of seams of the Kuznets Basin.

- 62 -

RESTRICTED

RESTRICTED

The results are shown in Table 20.

The analyses of ash, collected at the Stalinogorsk GRES and Kashir GRES, and also a series of screenings, collected at gas-producing stations, which operate on coal from the Chelyabinsk Field, are shown in Table 21.

The Kashir and Stalinogorsk GRES operate on coal from the Moscow field. The coal is burned in the form of pulverized fuel. Hence, the low, about 0.001 percent, content of germanium in all the samples of ash becomes clear, including also in the volatile part of the ash, for example, which collects in the Cottrell precipitator. According to our preliminary determinations, the coals of the Moscow Field are characterized by a low germanium content. During the burning of the coal in the form of pulverized fuel, a considerable part of the ash, which usually remains in the form of slag, is carried off by the current of air and is deposited in different parts of the chimney. In addition, the volatile part of the ash, usually containing germanium, is deposited individually and mixed with the ash of the slag.

It should be noted that the slag and ashes, collected from industrial furnaces which are operated on Khumarin coal, which has an extremely high average content of germanium, nearly 0.05 percent, calculated for the ash, contained germanium of about 0.001 percent, which is in complete accordance with the data concerning the low content of germanium in the slag from the coal of the Donets Basin (compare with Table 8).

Quite different results are obtained in the analysis of the waste from gas-producing stations, which operate on brown coals from the Chelyabinsk Basin.

RESTRICTED

Table 19

Content of Ge in the Coals of Khumarin Deposit (in %)

No. of Sample	Name of Material	Place of Taking Sample	Ash Content	Percentage of Ge in the Ash
(1)	(2)	(3)	(4)	(5)
1	Clarain-vitrain with thin layers of slate and sedimentations of salts	From the soil of the strata	16.3	0.005
2	The same	From covering of the strata	10.0	0.004
4	" "	Seam in the covering of the strata	21.5	0.005
6a	" "	The same	24.2	0.013
8	Lens vitrain	From the soil of the strata	3.16	0.168
11	Clarain-vitrain with thin layers of slate and sedimentations of salts	Seam in the covering of the strata	8.5	0.099
13	The same	From the soil of the strata	3.8	0.024

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
14	The same	From covering of the strata	6.0	0.015
16	" "	From the soil of the strata	6.0	0.004
17	Clarain-vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	4.3	0.004
18	The same	Seam in the covering of the strata	9.0	0.148
21	" "	From the soil of the strata at end with faults	13.8	0.026
21	" "	The same	10.2	0.008
22	" "	From the soil of the strata at end with faults	10.7	0.018
24	Vitrain	Seam in the covering of the strata;		

-65-

RESTRICTED

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
14	The same	From covering of the strata	6.0	0.015
16	" "	From the soil of the strata	6.8	0.004
17	Clarain-vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	4.3	0.004
18	The same	Seam in the covering of the strata	9.0	0.148
21	" "	From the soil of the strata at end with faults	13.8	0.026
21	" "	The same	18.2	0.008
22	" "	From the soil of the strata at end with faults	10.7	0.018
24	Vitrain	Seam in the covering of the strata;		

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
		near a fault	6.5	0.153
27	Clarain-vitrain with thin layers of slate and sedimentations of salts	At 15 cm from the soil of the strata; near a fault	23.0	0.002
28	The same	From covering of the strata	4.3	0.009
30	" "	From covering of the strata; at a fault	13.7	0.035
32	Pure Clarain-vitrain without slate	Middle of strata	2.5	0.054
35	Clarain-vitrain with thin layer of slate and sedimentations of salts	From the soil of the strata	6.7	0.002
36	The same	Upper part of strata	4.7	0.004
38	" "	Seam of coal; in the covering of the strata	24.0	0.003

-66-

RESTRICTED

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
41	The same	From the soil of the strata	7.3	0.003
42a	Slate	Covering of the strata	85.6	<0.001
43	Clarain. Lustrous, homogeneous, with sedimentations of salts in the fissures	From the soil of the strata	8.3	0.002
44	Clarain-Vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	4.0	0.004
45	The same	From the soil of the strata	3.1	0.011
46	Clarain-vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	17.3	0.003
46	Vitrain	... The same ...	3.3	0.113
48	Clarain-vitrain with large content of vitrain	From the soil of the strata	8.8	0.129

RESTRICTED

Table 19 (continued)

(1)	(2)	(3)	(4)	(5)
49	Clarain-vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	6.5	0.011
51	Slate	Middle of strata	64.2	<0.001
53	Clarain-vitrain with thin layer of slate and sedimentations of salts	From upper part of strata	11.6	0.027
54	Clarain-vitrain with thin layer of slate and sedimentations of salts	From the whole strata	12.1	0.054
54	The same	The same	16.1	0.009
55	Vitrain	" "	3.5	0.588
55	Clarain-vitrain with thin layer of slate and sedimentations of salts	" "	34.6	0.003
58	The same	From the soil of the strata	29.8	0.002
59	Clarain-vitrain with	From covering		

-68-

RESTRICTED

RESTRICTED

Table 19 (continued)

(1)	(2)	(3)	(4)	(5)
	predominance of vitrain	of the strata	8.0	0.105
60	Clarain-vitrain with thin layer of slate and sedimentations of salts	Middle of strata	5.5	0.030
60	Clarain-vitrain with thin layer of slate and sedimentations of salts	Middle of strata	7.6	0.025
61	The same	The same	4.0	0.044
63	" "	From the soil of the strata	5.5	0.008
64	" "	From covering of strata	4.3	0.006
66	" "	Middle sample of the strata	9.2	0.009
67	Pure Clarain-vitrain	The same	1.8	0.051
67	Clarain-vitrain with thin layer of slate and sedimentations of salts	" "	32.3	0.008

-69-

RESTRICTED

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
71	The same	From the soil of the strata	14.2	<0.001
71	" "	The same	13.2	<0.001
72	" "	From covering of the strata	13.1	<0.001
72	" "	The same	15.7	<0.001
73	" "	Middle sample of the strata	15.5	<0.001
73	" "	The same	18.0	0.004
76	" "	From the soil of the strata	8.2	0.013
78	Clarain-vitrain with predominance of vitrain	Middle sample of the strata	5.5	0.191
84	Clarain-vitrain with thin layer of slate and sedimentations of salts	From the whole strata	5.1	0.036
86	The same	From covering of the strata	26.0	0.003

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
88	The same	From the soil of the strata	7.5	0.038
89	Clarain-vitrain with thin layer of slate and sedimentations of salts	From covering of the strata	6.8	0.005
91	Clarain-vitrain with thin layer of shale and sedimentations of shale salts	From the soil of the strata	14.2	0.005
92	The same	From covering of the strata	12.3	0.006
93	" "	The same	4.4	0.054
95	" "	From the soil of the strata	6.6	0.063
96	" "	From covering of the strata	13.6	0.005
101	" "	Middle of strata	6.8	0.004
102	" "	From covering of the strata	4.0	0.007
107	" "	From the soil of the strata	12.5	<0.001

- 71 -
RESTRICTED

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
108	The same	From covering of the strata	4.3	0.066
109	" "	From the soil of the strata	8.9	0.002
111	" "	From covering of the strata	10.7	0.007
112	" "	From the soil of the strata	8.7	0.005
118	" "	From covering of the strata	9.3	0.013
119	" "	From the soil of the strata	7.8	0.007
122	" "	The same	7.3	0.006
123	" "	From covering of the strata	6.7	0.027
125	Shale	From the soil of the strata	65.6	<0.001
126	Clarain-vitrain with thin layer of shale and sedimentations of salts	From covering of the strata	25.5	<0.001

RESTRICTED

Table 12 (Continued)

(1)	(2)	(3)	(4)	(5)
128	Clarain-vitrain with thin layer of shale and sedimentations of salts	From covering of the strata	13.3	0.003
129	The same	From the soil of the strata	13.8	0.035
132	" "	The same	3.7	0.003
140	" "	From covering of the strata	3.8	0.082
145	Clarain-vitrain with thin layer of shale and sedimentations of salts	The same	3.3	0.052
153	The same	From the soil of the strata	9.2	0.045
153	" "	The same	17.7	0.020
154	" "	From covering of the strata	10.2	0.020
157	Clarain-vitrain with predominance of vitrain	The same	5.6	0.157

RESTRICTED

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
158	Clarain-vitrain with thin layer of shale and sedimentations of salts	From the soil of the strata	11.1	0.016
159	The same	From covering of the strata	6.6	0.023
160	" "	From the soil of the strata	9.8	0.004
160	Pure vitrain	The same	1.4	0.986
162	Clarain-vitrain with thin layer of shale and sedimentations of salts	Middle of strata	5.5	0.027
164	Clarain-vitrain with thin layer of shale and sedimentations of salts	From the soil of the strata	4.7	0.013
170	The same	From the whole strata	4.5	0.012
170	" "	The same	10.7	0.005
171	" "	From the soil of the strata	9.5	0.004

RESTRICTED

Table 19 (Continued)

(1)	(2)	(3)	(4)	(5)
183	The same	At 12 meters from the dike of the igneous rocks	12.0	0.008
186	" "	Middle of strata	9.8	0.007
187	" "	From covering of the strata	12.5	0.006
188	" "	From the soil of the strata	17.6	0.005
189	" "	Middle of strata	14.7	0.002
190	Vitrain	From covering of the strata	2.3	0.815
192	Clarain-vitrain with thin layer of shale and sedimentations of salts	From the soil of the strata	9.7	0.006
195	The same	From the soil of the strata	10.3	0.003
197	" "	The same	29.2	0.001
198	" "	" "	35.2	<0.001
199	Coal, homogeneous, semi-lustrous, hard	Middle of strata	7.3	<0.001

RESTRICTED**Table 19 (Concluded)**

(1)	(2)	(3)	(4)	(5)
199	The same	The same	5.6	0.006
201	Pure clarain-vitrain	From the soil of the strata	6.7	0.074

RESTRICTED

RESTRICTED

So considerable a concentration of germanium in the waste, up to 0.3 percent, calculated in the ash, permits us to consider these wastes as material for the industrial extraction of germanium.

Table 20

Content of Ge in the Coals of Different Deposits (in %)

Description of the Material	Ash Content	Content of Ge in the Ash
Kuznets Field		
Average Sample of Bed		
Lenin Mine, Pit A		
Polenov Bed.....	10.7	<0.001
Makaimov "	6.6	0.001
Lenin Mine, Kirov Pit		
Tolmachev Bed	6.8	0.003
Snyatkov "	13.6	0.001
Breyev "	22.7	<0.001
Yemel'yanov Bed	18.1	<0.001
Beldyrev "	14.0	<0.001
Lenin Mine, Pit imeni 7 November		
Merenkov Bed	11.8	<0.001
Chertyn Deposit, 1 May Pit		
Bed Five	12.6	<0.001
Bolov Deposit, "Pioneer" Pit		
Bed Five.....	4.2	0.005
Semi-lustrous Coal, Prokop'yev Deposit,		
Black Mountain Pit		
Double Bed	4.7	0.010

(cont. next page)

- 77 -
RESTRICTED

RESTRICTED

(Table 20 - cont.)

Description of the Material	Ash Content	Content of Ge in the Ash
Semi-lustrous Coal, Kiselev Deposit,		
Altay Legprom Gallery		
VIII Interior Bed	4.6	0.004
Semi-dull, Hard Coal	18.8	0.001
Kiselev Deposit, No. 3 Pit		
VIII Interior Bed	18.8	<0.001
Semi-dull, Granular Coal, Kiselev Deposit,		
Red Kuzbas Gallery No. 6		
II Interior Bed	6.1	0.002
Individual Samples		
✓ Bitrain, Andzhero-Sundzhen Region	1.7	<0.001
Liptobilit, Berdes' Deposit.....	27.6	<0.001
Chelyabinsk Field (Ural)		
Korkin Deposit		
Clarain-vitrain, Pit No. 1, 46 meter level ...	2.7	0.004
Clarain-vitrain with small content of fusain,		
Pit No. 1, 46 meter level	3.5	<0.001
Typical sample of coal of low ash content.....	---	---
Clarain-vitrain, highly weathered, Pit No. 2,		
from pot of highly crumbled coal	5.2	0.001
Clarain-vitrain with a large content of		
vitrain, Pit No. 2, from face of southern		
crosscut.....	1.3	0.008
Pure Vitrain with traces of a ligneous struc-		
ture, Pit No. 2, from top of pot.....	1.5	0.020

- 78 - RESTRICTED

RESTRICTED

(Table 20 - cont.)

Description of the Material	Ash Content	Content of Ga in the Ash
Clarain-vitrain with a small quantity of fusain and fine layers of shale, Pit No. 1, 35 meter level	14.4	<0.001
Fusain with a small mixture (5-10%) of clarain, Pit No. 2, northern crosscut.....	12.2	<0.001
Vitrain, Pit No. 2, northern crosscut	1.7	0.003
Pure Clarain-vitrain with a large content of vitrain, Pit No. 2, from pot of highly crumbled coal.....	1.3	0.004
Clarain-vitrain, Pit No. 2, eastern crosscut No. 1	4.5	<0.001
Vitrain with a small quantity of shale and sedi- mentations of salts, Pit No. 2, Drenashnaya Bed	3.0	0.001
Clarain-vitrain with a small admixture of fusain, typical sample for coals of low ash con- tent, Pit No. 1, 40 meter level	4.5	<0.001
Clarain-vitrain, Pit No. 2, near the western crosscut No. 1	3.5	<0.001
Clarain-vitrain with a small quantity of fusain and fine layers of shale, typical sample for coals of low ash content, Pit No. 2, deepest part of the basin	4.3	<0.001
Fusain with a small content of clarain-vitrain, 5-10%, Pit No. 1, 35 meter level	10.6	0.001

(cont. next page)

-79-

RESTRICTED

RESTRICTED

(Table 20 cont.)

Description of the Material	Ash Content	Content of Ca In the Ash
Mineralized wood with coal, Pit No. 1, 35 meter level	36.9	<0.001
Clarain-vitrain with a predominance of vitrain, Pit No. 2, near the beginning of the western crosscut No. 2	2.8	0.002
Pure clarain-vitrain, without visible layers of shale, Pit No. 1, 35 meter level....	3.2	0.001
Clarain-vitrain with fine layers of shale, Pit No. 1, 35 meter level	5.2	<0.001
Mineralized wood with coal, coal found in wood in the form of fine layers of up to 2 millimeters thickness, Pit No. 1, 35 meter level	46.6	<0.001
Clarain-vitrain, taken at point of contact with mineralized wood, st. previous sample, Pit No. 1, 35 meter level	3.5	0.001
Clarain-vitrain with thin layers of shale, Pit No. 2, eastern crosscut No. 1	11.8	<0.001
Fus ^a in from the same sample, Pit No. 2, eastern crosscut No. 1	9.4	<0.001
Vitrain	1.5	0.002
Korkin Deposit, Pit No. 1, 35 meter level .	1.5	0.002
Clarain-vitrain with sedimentations of sulfides, Pit No. 2, near the western crosscut No. 1	3.3	0.001

(cont. next page)

- 80 -

RESTRICTED

RESTRICTED

(Table 20 cont.)

Description of the Material	Ash Content	Content of Ga In the Ash
Mineralized wood with coal, Pit No. 1, 35 meter level	36.8	<0.001
Clarain-vitrain with a predominance of vitrain, Pit No. 2, near the beginning of the western crosscut No. 2	2.8	0.002
Pure clarain-vitrain, without visible layers of shale, Pit No. 1, 35 meter level....	3.8	0.001
Clarain-vitrain with fine layers of shale, Pit No. 1, 35 meter level	5.2	<0.001
Mineralized wood with coal, coal found in wood in the form of fine layers of up to 2 millimeters thickness, Pit No. 1, 35 meter level	48.6	<0.001
Clarain-vitrain, taken at point of contact with mineralized wood, at previous sample, Pit No. 1, 35 meter level	3.6	0.001
Clarain-vitrain with thin layers of shale, Pit No. 2, eastern crosscut No. 1	11.8	<0.001
Fus ^a in from the same sample, Pit No. 2, eastern crosscut No. 1	9.4	<0.001
Vitrain	1.5	0.002
Korkin Deposit, Pit No. 1, 35 meter level .	1.5	0.002
Clarain-vitrain with sedimentations of sulfides, Pit No. 2, near the western crosscut No. 1	3.3	0.001

(cont. next page)

- 80 -

RESTRICTED

RESTRICTED

(Table 20 cont.)

Description of the Material	Ash Content	Content of Ge In the Ash
Clarain-vitrain (vitrain about 5%) with a small quantity of fusain (up to 3%) and thin layers of shale hardly visible to the naked eye, a typical sample for coals of low ash content, Pit No. 1, 35 meter level	5.8	<0.001
Kopey Deposit of Clarain-vitrain with a large content of vitrain, Bed 205	1.7	0.003
Yemanshelin Deposit of Clarain-vitrain, Baturin Section, Pit-hole No. 228, sample from a depth of 30 meters	8.5	<0.001
Yegorshin Field		
Anthracite with traces of graphitization, Bursunka Bed, Pit No. 7, Seam VI	27.7	<0.001
Anthracite strongly graphitized, Bursunka Bed, 130 meter level, Seam VI	32.3	<0.001
Carbonaceous shale, layer in anthracite, Bursunka Bed, 130 meter level, Seam VI ..	73.0	<0.001
Anthracite weakly graphitized, Bed imeni Kirov, Seam 1	8.5	<0.001
Anthracite strongly graphitized, Bed imeni Kirov, 110 meter level, Seam VI	13.2	<0.001
Carbonaceous shale, layer in anthracite, Bed imeni Kirov, 110 meter level, Seam VI ...	70.7	<0.001

(cont. next page)

- 81 -

RESTRICTED

RESTRICTED

(Table 20 - cont.)

Description of the Material	Ash Content	Content of Ge in the Ash
Anthracite strongly graphitized, Bed imeni Kirov, 110 meter level, Seam VI.....	29.5	<0.001
Graphitized anthracite, Bed imeni Kirov, 165 meter level, Seam I.....	3.5	<0.001
Other Deposits		
Durain, typical, speriferous, Kiselev Field.	9.7	0.001
Striated, represented chiefly by clarain and fusain, Araganda	9.1	<0.001
Coal, reminiscent of bitumen, South Ural, Terekla River	13.7	0.002
Coal of the clarain type, Suchan Deposit....	4.9	0.001
Coal of the clarain type, Cherenkhov Deposit	8.0	0.002
Gagat, Krym, Beshuy Deposit	0.7	0.001
^{kh} Bal x ashit, Lake Balkhash	6.2	<0.001
Vitrain with a small quantity of fusain and clarain, Vladivostok Rayon, Suchan River	6.5	0.001
Coal of the clarain type, Sakhalin, October Mine	5.2	<0.001
Coal of the clarain type, Sakhalin, Duy Mine	3.2	<0.001
Bumazhnyy coal, Moscow Fields, Tovarkovo....	16.7	0.001

(cont. next page)

RESTRICTED

RESTRICTED

(Table 20 - cont.)

Description of the Material	Ash Content	Content of Ge in the Ash
Boghead, Moscow Fields, Bobrikov Mine.....	18.1	<0.001
Boghead, Torbant, Scotland; Hohendorf, near Zwickau, Saxony	5.4	<0.001
Vitrain	1.2	0.300
Fusain	3.0	<0.001
Vitrain (obtained from the museum of the Kazan University)	2.1	0.001

RESTRICTED

Table 21

**Content of Ge in the Ashes of Electric Stations
and the Waste Products of Gas-producing
Stations (in %)**

Designation of Material	Ash Content	Content of Ge in Ash
(1)	(2)	(3)
Kashir GRES		
Sample of ash from dust extractors of		
Boiler No. 4	100	0.001
Sample of fine ash from dump	100	0.001
Sample of coarse ash and slag from dump .	100	0.001
Slag from dump	100	0.000
Stalinoorgorsk GRES		
Sample No. 1 from Boiler No. 1	100	0.001
Sample No. 2 from Boiler No. 4	100	0.001
Ash collected in the Cottrell filter . . .	100	0.001
Ash under the waste gas heater in the gas process	100	0.001
Ash from the ash settler	100	0.001

RESTRICTED

Table 21 (Concluded)

(1)	(2)	(3)
Gas-producing Stations		
Slag	~ 100	< 0.001
Soot, coal dust, heavy tar from the forkyuller	18.70	~ 0.050
Tar from the condensation vessel	2.14	~ 0.050
Lower layer of the tar-preserver	0.48	~ 0.100
Upper layer of the tar-preserver	0.02	~ 0.300

RESTRICTED

It is desirable to continue further the analysis of the products of coal processing, which are obtained from coal with a higher original content of germanium than coals of the Chelyabinsk field, and, in this respect, first of all the volatile part of the ash of gas plants. Such an analysis, it is possible, will lead to the discovery of a raw material that is still richer in germanium than those already located.

4. Survey of the Hypotheses Concerning the Extraction of Germanium from Coals

V. M. Goldschmidt, in his earlier works (Goldschmidt and Peters, 1933_{1,2}), calculates that the concentration of germanium in coals is the result of adsorption and reduction of germanium which is contained in the circulating waters.

In later works (1937), V. M. Goldschmidt arrives at the conclusion that the concentration of germanium is connected with the activity of the ligneous plant.

According to V. M. Goldschmidt, the content of germanium in coal is connected largely with the coal itself and only insignificantly with the shale that is mixed with it. The lower the total quantity of ash, the higher the content of germanium in the ash. An analysis of several samples with different ash contents, taken from one seam, gave the results listed in Table 22.

V. A. Zil'bermintz, A. K. Rusanov and V. M. Kostrikin, by their investigations, chiefly of coals from the Donets field, confirmed the conclusion of V. M. Goldschmidt concerning the concentration of germanium in coals having a low ash content (see Table 23).

- 86 - RESTRICTED

RESTRICTED

Table 22

Comparison of the Ash Content of Coal with the Content
of GeO_2 (according to Goldschmidt and Peters)

Ashes of Coals from One Seam in Silesia	Content of GeO_2 in % in the ash (Roentgen)
Sample with 1.6% ash	0.2
" " 3.6% "	0.1
" " 8.8% "	0.01
" " 14.1% "	0.01
" " 27.5% "	0.001 - 0.01

Table 23

Comparison of the Ash Content of Coal with the Content
of Germanium (According to Zil'bermintz,
Rusanov and Kostrikin, 1934)

Content of Ge in the Ash, %	Number of Determinations	Range of Content of Ash, %	Average % of Ash
0.1 - 1	11	1.40 - 5.36	2.97
0.01 - 0.1	42	1.01 - 25.15	4.25
< 0.01	62	0.66 - 27.00	5.34
0	78	0.92 - 28.70	5.70

RESTRICTED

RESTRICTED

The primary source of the germanium concentration in coals, according to V. A. Zil'bermintz, A. K. Rusanov and V. M. Kostrikin (1936) are aqueous solutions, which are found in connection with effusive rocks, broadly developed in the region of the Donets Basin.

Following the direction indicated by V. M. Goldschmidt concerning the concentration of germanium in zinc blendes, which are formed from cold solutions, the above-named authors explain the accumulation of germanium by the presence of waters which circulate in the seams of coal and by the nature of the distribution of sulfide minerals in the various parts of the seams. The circulation of the waters also explains the increased quantity of germanium in the lower part of the coal seams in comparison with the upper part, which was observed by the authors in a number of cases.

The concentration of germanium in the coals of the Donbas V. A. Zil'bermintz and his co-authors attempt to explain also by the structure of the field; considering that the areas of minute folding at the edge of part of the field are distinguished by a maximum concentration of germanium, the area then of the main anticlinal fold (the central part) is distinguished by a minimum content.

The uneven distribution of germanium in the coal seams V. A. Zil'bermintz and his co-authors explain by the existence of some local conditions which exert a definite influence on the direction of the process of germanium accumulation; at the same time, though, nothing is said concerning these conditions. This question itself of the uneven distribution of germanium in coals

RESTRICTED

RESTRICTED

they leave open.

Attempting by an external criterion to separate the coals that are rich in germanium, V. A. Zil'bermints, A. K. Rusanov and V. M. Kostrikin calculated that only the coals of the Ural region can possess the characteristic morphological criteria; the Ural coals, which are the ^{clarain}klaren-vitrain formations, often preserve the carbonization of the wood. Donets and Khumarin coals, according to the data of these authors, are usually the types of coal that contain particles of different structural varieties.

Citing a number of reasons, each of which could lead to the accumulation of germanium in coals, and not indicating a preference for any one of them, V. A. Zil'bermints and his co-authors do not, by means of these reasons themselves, produce hypotheses concerning the origin of germanium in coals.

V. M. Kostrikin explains the accumulation of germanium in coals (1939), according to V. M. Goldschmidt, by concentration as a result of the activity of plants, and also by adsorption by the coal during the coalification process. The highest content of germanium V. M. Kostrikin calculates, according to Goldschmidt to be characteristic of coals of low ash content.

A. I. Yegorov and S. K. Kalinin connect the accumulation of germanium with the geological age of the coals, and consider the highest concentration of germanium to be characteristic of the Mesozoic coals of Kazakhstan. Citing the statements of V. A. Zil'bermints, A. K. Rusanov and V. M. Kostrikin, they verify the accumulation of germanium in ^{clarain}klaren and vitrain coals. The highest concentration is registered for coals which consist of the

RESTRICTED

RESTRICTED

entire plant fragments, for lignites.

Yegorov and Kalinin explain the origin of germanium in coal as the absorption of germanium by the coal from the rocks enclosing it and from the solutions which circulated in them.

5. New Data on the Distribution of Germanium in Coals

A number of conclusions may be drawn from the work carried out concerning the nature of accumulation and distribution of germanium in coals.

The content of germanium is different for the coals of various coal fields and deposits. Within the individual coal fields and deposits the content of germanium varies greatly according to the separate strata and according to the slope and direction of the strata. In a number of cases the coals of an entire region have a concentration of germanium; much more often, samples of coal, selected at close intervals, produce a different content of germanium.

In order to explain the variation in the content of germanium in homogeneous coal within a single lump, we conducted a series of determinations on one sample. For the purpose of such an experiment a specimen was selected of the most homogeneous coal of the Khumarin deposit. The coal was completely homogeneous, so hard that upon abrasion the exterior resembled sapropelite. According to the determination, obligingly carried out on our sample by S. N. Naumova, it belonged to the humic type of coal (see Table 24).

RESTRICTED

RESTRICTED

Table 2A

Content of Os in different portions of one sample of coal (in percent)

no. of Determination	Os in the Ash	no. of Determination	Os in the Ash
1	0.000	5	0.004
2	0.004	6	0.003
3	0.000	7	0.002
4	0.007	8	0.005

The experiment which was carried out showed that even in surface lignite coals, the content of osmium varies one sample versus another. According to that, the selected, complex coals with different compositions must have shown a great variation.

Up to the present time, all investigation of rare elements in coals, among them osmium, were carried out without accounting for the great rapid composition of coals. V. N. Goldschmidt demonstrated that the concentration of osmium is characteristic of coals of low ash content, for example ~~lignite~~ ^{lignite}-vitrinite. This demonstration of Goldschmidt was reiterated further by other authors.

The analysis of Rhumaria coals, which are composed, basically, of strips of ~~lignite~~ ^{lignite}, alternating with strips of fine carbonaceous shale and argillite that are often hardly visible to the naked eye, and also with strips of vitrinite, took into account the petrographic structure of coal and afforded excellent material for checking Goldschmidt's position.

RESTRICTED

RESTRICTED

Table 25

Dependence of Ge Content on Petrographic Structure of Coal

No. of Sample	Type of Coal	Ash Content, %	Content of Ge in the Ash, %	Ratio of Ash Content in Different Portions of one Sample	Inverse Ratio of Ge Content in Different Portions of one Sample
21	Clarain-vitrain with thin layers of shale and sedimentations of salts	16.2	0.008	1.3	3.25
21	The same Contains large quantity of vitrain	13.3	0.026		
46	Clarain-vitrain with thin layers of shale and sedimentations of salts	17.3	0.003	5.2	37.7
46	Vitrain	3.3	0.113		
54	Clarain-vitrain with thin layers of shale and sedimentations of salts	16.1	0.009	1.3	6.0
54	The same Contains large quantity of vitrain	12.1	0.054		
55	Clarain-vitrain with thin layers of shale and sedimentations of salts	34.6	0.003	9.9	196.0
55	Vitrain	3.5	0.586		
160	Clarain-vitrain with thin layers of shale and sedimentations of salts	9.8	0.004	7.0	246.5
160	Pure vitrain	1.4	0.056		

RESTRICTED

Already, a cursory survey of the results of the analysis of Khumaria coals (Table 19) shows that the concentration of germanium is not by any means coordinated to clarain-vitrain. The concentration of germanium is coordinated to the petrographic diversity of coal, to vitrain. At the same time, the correlation between the content of germanium and the ash content of the coal is not observed, which it is possible to demonstrate by means of Table 20.

The origin of the separate components of coal, clarain and vitrain, is treated on the one hand as the result of the different duration of the processes of micro-biological decomposition of homogeneous plant material, and, on the other hand, as the result of diversity in the original material.

The first viewpoint was more clearly presented by D. White, who discussed the role of water in the formation of coals from peat bogs (1933). Vitrain is formed, according to D. White, during the rapid precipitation of plant material under water without a preliminary long period of decomposition of the micro-organisms. This takes place in stagnant ponds, where the water quickly becomes toxic and decomposition is unable to set in further.

A number of tissues are exposed to selective impregnation by hemic substances from the environment where they are found in a diffused state.

In the presence of aeration of the aqueous film, the toxicity of the water is lessened, the less sturdy plant elements undergo decomposition, and the situation is created for the formation of clarain.

RESTRICTED

RESTRICTED

However, the same results, according to Yu. A. Zhanchuzhnikov (1935), can be obtained also from the irregularity of accumulation and the diversity in the original material. Striated coal is formed in places where, at the bottom of low-lying peat bogs, pieces of wood, and especially of bark, fall and immediately are precipitated at a place of great fragmentation among finely ground down material. It is characterized by the presence of relatively large lines of vitrain and fine attrite, which, depending on the conditions of decomposition, is transformed, part into clarain, part into fusain.

Clarain quickly forms wherever there are accumulated herbaceous plants that are more or less rich in parenchyma.

It seems to us that vitrains of different coal deposits can be formed in different ways than is explained by the variation of the germanium content in them, a matter on which we will dwell further in detail.

In the comparison of vitrains and clarain-vitrains, taken from one and the same sample, the concentration of germanium in the vitrains, in all cases, appears more abruptly than the decrease in ash content. At the same time that the ratio of the ash content of clarain-vitrains and vitrains is expressed in ones, the ratio of the content of germanium in them is expressed in tens and hundreds (samples 16, 55, 160, Table 25).

In clarain-vitrains with a different content of vitrain, the ratio of the germanium content, also, is higher usually than the ratio of the ash content, corresponding to the relative content of vitrain (samples 21 and 54, Table 25).

RESTRICTED

RESTRICTED

Even in the comparison of samples of vitrain that are impure and consequently have a higher ash content with components of coal with a similar or even lower ash content, the germanium content in the vitrain usually appears to be considerably higher, which is demonstrated in Table 26.

In the striated coals of the Khumarin deposit the germanium concentration in the vitrain is especially instructive. As a model it is possible to carry out a layer analysis of one sample (see Table 27).

In the extremely high concentration of germanium in vitrain, nearly 1 percent in the ash (the maximum, registered for coals by V. M. Goldschmidt, constitutes 1.1 percent, in the determination by the X-ray spectrum method), the average sample contains in all only 0.010 percent germanium. The fluctuation of the germanium content does not correspond to the fluctuation of the ash content of the components of the coal; thus in the increase of the ash content by 10 times, the germanium content is decreased 100 times (Table 27, Nos. 1 and 5).

RESTRICTED

Table 26

Comparison of Ash Content and Germanium Content
in Vitrain and Clarain-Vitrain (in %)

No. of Sample	Type of Coal	Ash Content	Ge In Ash
17	Clarain-vitrain with thin layers of shale and sedimentations of salts	4.3	0.004
24	Vitrain	6.5	0.153
8	Lens of vitrain	3.16	0.168
32	Pure clarain-vitrain	2.5	0.054
45	Clarain-vitrain with thin layers of shale and sedimentations of salts.	3.1	0.011
46	Vitrain	3.3	0.113
55	The Same	3.5	0.588
67	Pure clarain-vitrain	1.8	0.051
132	Clarain-vitrain with thin layers of shale and sedimentations of salts.	3.7	0.003
190	Vitrain	2.3	0.815

RESTRICTED

RESTRICTED

General analysis of sulfide minerals were performed by the method of B. B. B. for all the samples. The results of analysis, in which it is possible to make the quantity of sulfur content reported to the intensity of the spectrum lines, are given in Table 1.

The analysis showed that these minerals are sulfides of iron, copper, zinc, and silver. In all of them, however, the content of sulfur is not the same. The content of sulfur in the minerals is not the same, and the concentration of sulfur in the minerals is not the same. The content of sulfur in the minerals is not the same.

The samples of sulfides No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

exactly in the same way the indication of L. A. Sil'berman and his co-authors on the concentration of uranium in fossilized wood as a result of sorption from circulating aqueous solutions did not have exception.

The fossilized wood of the L. A. Sil'berman and his co-authors is fossilized-amberized wood is especially well distributed, resulting from small fragments of well-preserved roots of woods, and which served as demonstration material at the XVII session of the International Geological Congress, yielded excellent material for checking the proposition in question.

-100-

RESTRICTED

RESTRICTED

All samples, without exception, of the mineralized wood contain a content of germanium less than 0.01 percent. In the case of the crystalline silicates, which have a high degree of contact with the mineralized wood, the content of germanium is also less than 0.01 percent (see Table 29).

The view of V. M. Goldschmidt concerning the process of germanium accumulation in soils by association with the activity of plants, chiefly under forest conditions, should be checked in more detail.

"Soil solutions dissolve inorganic substances of the subsoil depending on their solubility, inasmuch as normally we have only a small quantity of solvent in comparison with the mass of mineral substance. Such solutions penetrate into the organism of the plant through its roots, and a large part of the mineral substance is precipitated in the places of greatest evaporation, especially in the leaves. The falling leaves accumulate on the surface of the ground and, decomposing, are converted into humic substance" (Goldschmidt, 1937). From this V. M. Goldschmidt draws the conclusion that coals which are rich in germanium could be formed from mineral humic soils.

V. M. Goldschmidt supports his theory by reference to the experiments of Gellman and Bryunger (1932), which discovered a concentration of germanium in plants which were growing on ground into which germanium had been introduced synthetically, and also by his own analyses (see Table 29).

RESTRICTED

Table 29

Concentration of GeO_2 (in %) in the process of forming
Oak and Birch Humus (According to Goldschmidt, 1937)

Designation of Material	GeO_2 in the Ash
Mineral soil (sand)	0.0005
Ash of fresh oak leaves	0.0005
Ash of oak humus	0.007
Ash of birch humus	0.007

F. M. Goldschmidt's theory, extremely tempting at first glance, cannot, however, explain a number of observed facts.

The average content of germanium in the ashes of coals, concentrated in the elements under consideration, constitutes, according to F. M. Goldschmidt, 0.0 percent (1937). The formation of coals with a concentration of germanium exceeding by 100 times the content in the original plant material cannot be explained by the relative concentration in the process of decomposition; we do not know the processes leading to such a concentration.

Regarding the concentration of germanium in the process of the decomposition of the original plant material, Goldschmidt passes judgment on the basis of only one figure (see Table 29). In order to check his data, we conducted a determination of germanium on forest covering and plant material which was a component of this covering -- green leaves of a mixed forest and yellow leaves of the same variety in the grassy cover. Germanium was found in all of this material in a quantity of ≤ 0.001 percent, and a concentration of it was not found. Exactly in the same way it was not found in the ash of peat from a river valley bog (see Table 30)

RESTRICTED

Table 30

Content of Ge in Plant Material (in %)

Designation of Material	Ash Content	Ge in Ash
Peat, Kazanka River, Borisoglebskiy Bog,		
Upper Layer	16.7	0.001
Peat, Kazanka River, depth of 1 meter . .	17.2	0.001
Peat, Kazanka River, depth of 2 meters . .	27.0	0.001
Peat, Kazanka River, Kizicheskiy Bog,		
Upper Layer	19.0	0.001
Peat, Kazanka River, Kizicheskiy Bog,		
depth of 2 meters	13.1	0.001
Green leaves of mixed forest, Kazan . . .	8.6	0.001
Yellow leaves of mixed forest, Kazan . . .	14.4	0.001
Forest covering of mixed forest, Kazan . .	74.6	0.001
Grassy covering.	21.1	0.001

In the determination of germanium in coals, the sensitivity of the method of spectrum analysis of 0.001 percent was completely satisfactory. For the determination of germanium in plant material it must be increased. The work in this direction is known to us. The content of germanium in the material indicated in Table 30 comprises, approximately, about 0.0005 percent.

V. CONCLUSIONS

The accumulation of germanium, which takes place irregularly for the different components of coal, can be traced in the course of its penetration. The concentration of germanium in vitrain, which possesses the least sorption capacity, excludes the possibility of

RESERVED

sorption from solutions which have already been formed by the material. At the same time, in the process of its formation, vitrain passed through the stage of the most complete gelefication of the original plant material, during which the sorption of germanium apparently did not take place.

The nature of mineral coals in considerable measure is determined by the presence of an aqueous agent in places of sedimentation of the original plant material.

The biochemical disintegration of plant material that accumulated in a dry place led, according to G. L. Stadnikov (1937), to the formation of an accumulation of porous, unswollen humic acids. The migration of germanium into them was extremely difficult, if not completely impossible.

The accumulation and decomposition of plant material, which took place in the aqueous agent, led to the swelling of the humic acids in the first stages of coal formation. The more the humic acids swelled in the first stages of coal formation, the easier was the migration of germanium into them, the more complete was the process of gelefication [sic], which can lead to sorption of germanium by the gel of the humic acids.

The increased germanium content in lignites, which are the product of strongly geleficized wood, can be explained also by the decomposition in the aqueous agent.

It seems to us that the concentration of germanium in coals is bound by the mode of its origin to the retention of germanium by the gel of the humic acids from the aqueous solutions during the

RESTRICTED

period of decomposition of the original plant material. Portions of such material, previous to the stage of the most complete geolification, on further thickening was material for the formation of vitrain.

Various degrees of the concentration of germanium in vitrains of the different coal deposits is explained, probably, by the different quantities of solutions which served as the agent in the formation of coals, and also by the length of time the gel of the humic acids was in contact with the surrounding solutions.

The formation of vitrains with a higher content of germanium is connected, it seems, with the slower accumulation and decomposition of the original plant material, in the process of which the germanium was taken out of the solutions by the gel of the humic acids.

The concentration in coals simultaneously of germanium and a whole series of rare elements is developed by V. M. Goldschmidt as an argument for the accumulation of these elements in the process of plant activity. This statement, it seems to us, is not based on sufficient grounds. Thus, for example, the accumulation in coals of arsenic, according to the statement of Goldschmidt himself, which accompanies the accumulation of germanium, must originate simultaneously with the accumulation of the latter, having as a source the same aqueous solutions.

On the basis of explicit considerations, it is possible to suggest that humic coals must contain more germanium than sapropelic coals. Of humic coals, under stable, equal conditions, the allochthonous must be richer than the autochthonous.

Not excluded is the possibility that in the formation of

RESTRICTED

RESTRICTED

period of decomposition of the original plant material. Portions of such material, previous to the stage of the most complete gelefication, on further thickening was material for the formation of vitrain.

Various degrees of the concentration of germanium in vitrains of the different coal deposits is explained, probably, by the different quantities of solutions which served as the agent in the formation of coals, and also by the length of time the gel of the humic acids was in contact with the surrounding solutions.

The formation of vitrains with a higher content of germanium is connected, it seems, with the slower accumulation and decomposition of the original plant material, in the process of which the germanium was taken out of the solutions by the gel of the humic acids.

The concentration in coals simultaneously of germanium and a whole series of rare elements is developed by V. M. Goldschmidt as an argument for the accumulation of these elements in the process of plant activity. This statement, it seems to us, is not based on sufficient grounds. Thus, for example, the accumulation in coals of arsenic, according to the statement of Goldschmidt himself, which accompanies the accumulation of germanium, must originate simultaneously with the accumulation of the latter, having as a source the same aqueous solutions.

On the basis of explicit considerations, it is possible to suggest that humic coals must contain more germanium than sapropelite coals. Of humic coals, under stable, equal conditions, the allochthonous must be richer than the autochthonous.

Not excluded is the possibility that in the formation of

RESTRICTED